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Monterey, California

THESIS

M321

AN EVALUATION OF THE QUALITY OF TRAINING AND USABILITY OF THE FLEET MANAGEMENT SYSTEM-REAL TIME (FMS-RT)

by

Michael Gerard Mansfield

September 1988

Thesis Advisor: Nancy C. Roberts

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This thesis recommends ways to improve the content of the training curriculum and software usability of the Fleet Management System-Real Time (FMS-RT). The premise of this thesis is that the Navy should increase its performance during major overhauls and availabilities. According to experts, the current FMS-RT training program could be improved with the addition of three curriculum areas: project management training, advanced project management estimating techniques, and the more specific assignment of responsibilities in the implementation of the program. In addition, many problems and possible enhancements to the FMS-RT software were identified by our usability survey. Incorporating these changes to the training curriculum and software should allow the navy to increase ships force performance during overhauls.

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An Evaluation of the Quality of Training and Usability of the Fleet Management System-Real Time (FMS-RT)

by

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Lieutenant, United States Navy
B.S., State University of New York Maritime College, 1983

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN INFORMATION SYSTEMS

from the

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September 1988

ABSTRACT

This thesis recommends ways to improve the content of the training curriculum and software usability of the Fleet Management System-Real Time (FMS-RT). The premise of this thesis is that the Navy should increase its performance during major overhauls and availabilities. According to experts, the current FMS-RT training program could be improved with the addition of three curriculum areas: project management training, advanced project management estimating techniques, and the more specific assignment of responsibilities in the implementation of the program. In addition, many problems and possible enhancements to the FMS-RT software were identified by our usability survey. Incorporating these changes to the training curriculum and software should allow the navy to increase ships force performance during overhauls.

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I. INTRODUCTION

The Fleet Management System-Real Time (FMS-RT), a relatively new computer system, was introduced to the fleet on 1 January 1988. The FMS-RT system is a portable stand-alone system that is delivered to fleet units going through overhauls or major industrial availabilities of greater than four months in duration. The overhauls and availabilities that utilize FMS-RT are: Complex Overhauls (COHs), Regular Overhauls (ROHs), Drydock or Extended Docked Scheduled Restricted Availabilities (DSRAs and EDSRAs), Drydock or Extended Docked Phased Maintenance Availabilities (DPMAs and EDPMAs), and any other availability requested by the type commander (TYCOM).

The FMS-RT system replaced the fleet Ship's Force Overhaul Management System (SFOMS). The system was required due to the Navy's decision to eliminate the use of the INFONET system, the backbone telecommunications network for SFOMS. Naval Sea Systems Command Automated Data Systems Activity (SEAADSA) was given two years to design and install FMS-RT hardware and software, while Naval Sea Systems Command Detachment Planning Engineering Repairs and Alterations (PERA CRUDES) prepared the training program.

The objective of the FMS-RT system is to optimize the use of the ship's force personnel and maintenance resources during overhauls. The goal of the system is to increase performance so that overhauls will be shorter in duration and at a lesser cost to the government.

Of the many questions that could be addressed surrounding the FMS-RT system, two questions drive this research: (1) To what extent does the curriculum teach people to efficiently and effectively utilize the FMS-RT system in the management of resources in an overhaul environment? and (2) To what extent is the FMS-RT system usable by the end user? "End user" in this case means the person who directly interfaces with the computer and the people who utilize the input and output reports.

The premise of this thesis is that, with a quality software package and good training, the FMS-RT system would increase ship's force work performance. We are not testing this relationship; we are merely making the assumption that with good quality software and training, one can better utilize the FMS-RT system and thus increase performance.

It is therefore imperative that we define exactly what we are talking about in terms of training and software quality. We will begin with the issue of training.

What is training? What is meant when we say that we train people in the use of computer systems? Webster's *Ninth New Collegiate Dictionary* indicates that to train means "to teach so as to make fit, qualified, or proficient." [Ref. 1:p. 1251] Training means "the teaching, drill, or discipline by which powers of mind or body are developed: education." [Ref. 2:p. 2424]

Training can be assessed in many different ways. For example, we could investigate who conducts the training and how well they conduct it, what methods are used and how appropriate and successful they are, and what the content of the training curriculum is and whether it contains all the necessary and sufficient information the learner needs to know and master. The focus of this thesis is on the contents of the curriculum, or what we refer to as the training curriculum—the lecture topics and the supplemental information contained in hand-outs, diagrams, and other documents.

We chose the content of the training curriculum because it is established and we have experts in shipboard overhauls who can review the materials to ascertain if what is being covered is what should be covered in the limited training time available. Training content is an issue because the number of training phases have decreased with the installation of the FMS-RT system, and because overhauls are of such a relatively short duration (four months to a year) that we cannot afford a large learning curve on a system if we are to get increased performance from that system.

Our second issue is that of software. What is the quality of the FMS-RT software? Numerous criteria exist to judge the quality of software. For example, we see in Pressman's book on Software Engineering [Ref. 3:pp. 452–463] that there are various factors that can be used to evaluate the success of any software. The McCall, et al., model [Ref. 3:p. 454] illustrates the factors, their use, and some of the metrics used for their measurement (see Figure 1).

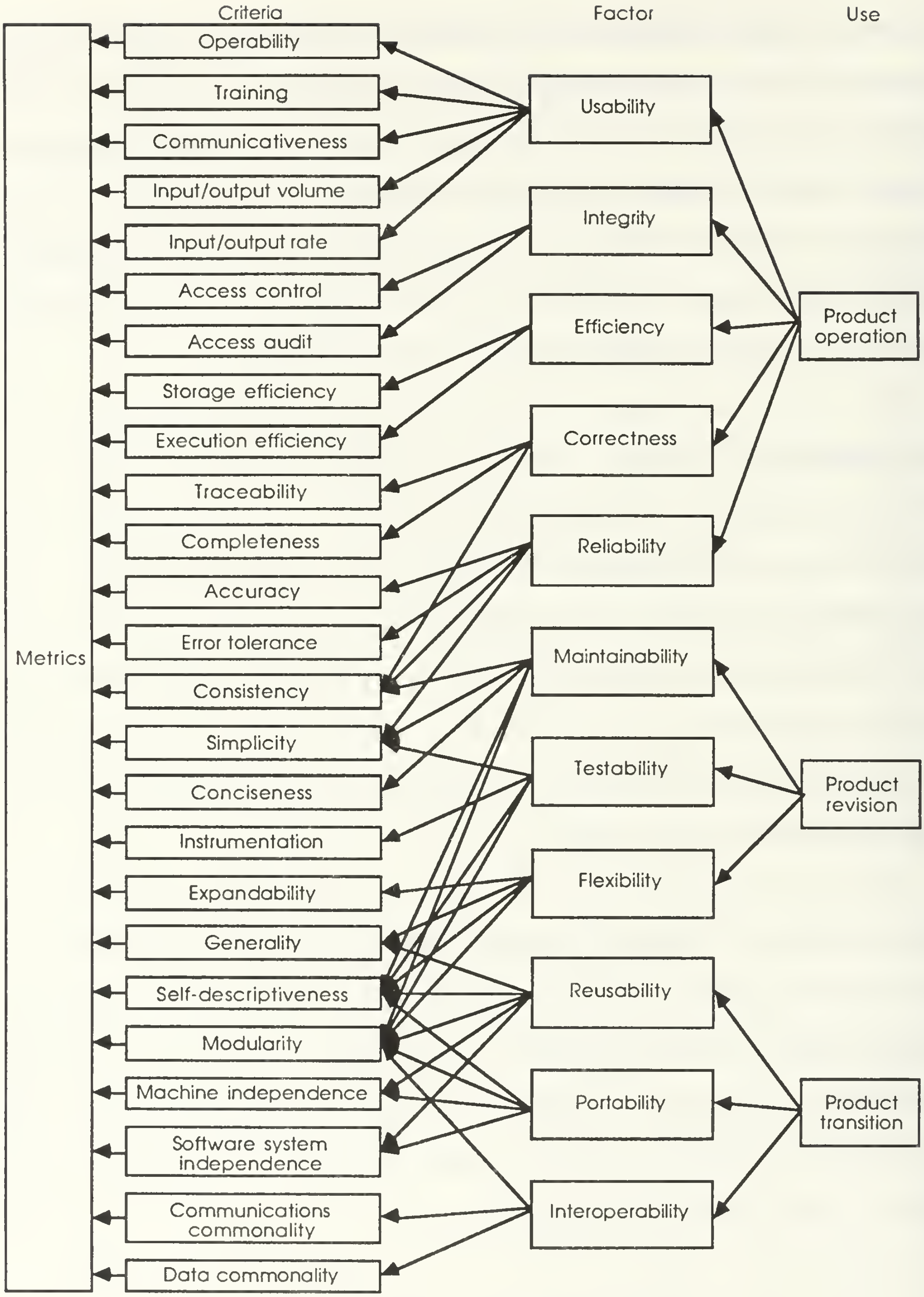


Figure 1. **McCall, et al., Model**

McCall's model has three uses: product operation, product revision, and product transition. These uses translate to factors which have measurable criteria or metrics. Since FMS-RT is a new software product, revision and transition issues are of lesser importance than product operation. The five factors of product operation are usability, integrity, efficiency, correctness, and reliability. Efficiency and integrity are controlled by the FMS-RT user through restricted access to the system and there is little need to optimize the computer's efficiency. The factors most important to the researcher are usability, reliability, and correctness. Usability is initially important because if we cannot initially use a system we do not need to worry about issues like reliability or correctness.

This study evaluates the usability factor. Can the user easily operate the FMS-RT system? Usability is the quality or state of being useable. Useable means capable of being used; convenient and practicable for use [Ref. 1:p. 1299]. We investigate usability because at present the Navy has very little actual user involvement in system development. This lack of user involvement often leads to systems that work but which, due to their complexity, cannot be or are not used proficiently in the fleet.

To summarize our research, this paper investigates two overlapping issues—training curriculum and usability. We assume that, given an appropriate training curriculum and a usable piece of software, we should get increased performance from our ship's work force during the overhaul. Ultimately, recommendations are made to improve the

FMS-RT system based on what the actual users have to say about the usability of the system and on what experts in shipboard overhauls have to say about the training curriculum.

A. THESIS OVERVIEW

1. Chapter II: Background

a. Background of Overhaul Process and Ship's Force Role

This section provides a brief description of the funding for an industrial availability, the process of preparing a ship's alteration and repair package, and the process of distributing work between a contractor and the ship's force personnel. A general time line of the overhaul planning process is provided.

b. Background of Old Overhaul Management Systems and Problems

This section is divided into three parts. The first part describes the old manual tracking system and its problems. The second part describes the Ship's Force Overhaul Management System (SFOMS) and the problems with the system. The last part of this chapter illustrates two problems with developing any computer-based ship's force tracking system—infrequent use of the system and complexity of the system to the user.

2. Chapter III: Description of FMS-RT

This section gives a general description of the FMS-RT hardware and software as well as a description of FMS-RT as a management information system (MIS).

3. Chapter IV: Methodology

This section describes what data was collected, from the data was collected, and how it was collected.

4. Chapter V: Results

This section contains the data. The collected data is split between the training curriculum—current and optimal—and the usability survey results.

5. Chapter VI: Analysis

This section is an analysis of the results. We compare curriculum contents and identify usability problems. Interpretation of the data is presented to support these assessments.

6. Chapter VII: Recommendations and Conclusion

In addition to summarizing proposed enhancements to the FMS-RT system, recommendations are made for additional research into areas of study related to this thesis.

7. Appendices

Appendices are provided to assist the reader and to support textual material.

II. BACKGROUND

A. BACKGROUND OF OVERHAUL PROCESS AND SHIP'S FORCE ROLE

1. Overhaul Funding

The funds required to overhaul a ship run well into the millions of dollars. The current cost to overhaul one Spruance Class Destroyer is about $25 million. It is about $18 million to overhaul one frigate. The Navy overhauls ships based upon their class and that class's maintenance schedule. Therefore, on an annual basis we must set aside an enormous sum of money just for the maintenance and upkeep of our fleet.

Two groups conduct annual budgeting for overhauls. First, the type commander [TYCOMs are Commander Naval Surface Force Pacific (COMNAVSURFPAC) and Commander Naval Surface Force Atlantic (COMNAVSURFLANT)] budgets funds for the ships under his control. He funds general upkeep, maintenance, and repairs. Second, the Naval Sea Systems Command (NAVSEA) budgets funds for technical research and alterations designed to improve the capabilities of our ships. These two major claimants control the funds that are required to overhaul our ships. The Chief of Naval Operations must approve all alterations made on each ship, but the alterations are financed by NAVSEA.

The amount spent per ship and the number of ships overhauled are determined by the amount of money the Secretary of

Defense appropriates to the Chief of Naval Operations for each of these major claimants after the annual budget has been passed. A long-range ships schedule, which includes major industrial availabilities, aids these two commands and schedules ships for maintenance. An overhaul requires substantial financial resources from both the TYCOM and NAVSEA. The following section describes from where the financial estimates for the total cost of an overhaul come.

2. Overhaul Planning Process

Planning for an industrial availability requires the interaction of many programs, systems, and activities. The objective of this planning process is to define a work package, allocate available resources, obtain required materials, and schedule work. Because of the numerous variables involved in planning, this process is inherently difficult to manage.

A ship's overhaul package consists of two major types of work—alterations and repairs. Development of the two work packages proceeds along different paths through different chains of command, but both must be merged before the overhaul for review and initial planning.

The repair work package is generally developed and work accomplished by the following process:

a. The TYCOM tasks the appropriate Planning and Engineering for Repair and Alterations Command (PERA) to prepare the Ship's Alteration and Repair Package (SARP).

b. PERA schedules the ship to conduct a Pre-Overhaul Test and Inspection (POT&I). Generally, POT&I is scheduled about nine months prior to overhaul commencement.

c. PERA conducts a review of the Current Ship's Maintenance Project (CSMP), along with the results of the most recent annual INSURV inspection and POT&I to ascertain all the discrepancies with the ship.

d. PERA prepares the SARP, estimates the cost of overhauling the ship, and submits the package to the TYCOM.

e. TYCOM screens the SARP and approves the work package.

f. Contracts are awarded, material is ordered and staged for the overhaul, jobs are divided between shipyard or contractor and either ship's force or an intermediate maintenance activity (IMA), e.g., a SIMA, MOTU, or a tender.

g. Overhaul begins.

h. TYCOM approves new work as appropriate throughout the overhaul.

i. Overhaul ends and ship departs.

Development of the alteration package consists of the following tasks:

a. Planned alterations are listed in the Fleet Modernization Program (FMP). Alterations applicable to the ship are reviewed.

b. Approximately one year prior to the overhaul, PERA is tasked with advance planning for specific alterations.

c. The alterations are incorporated into the SARP and cost estimates are forwarded to the appropriate command after the alterations are ship-checked.

d. The CNO-funded alteration package is provided to TYCOM about six months prior to the overhaul.

e. The CNO alteration package is modified at the pre-arrival conference and the TYCOM-funded alterations are firmed.

f. Overhaul begins.

g. Overhaul ends and ship departs.

Developing the overhaul package by these processes results in certain problems. Typically, the SARP is prepared late and is of questionable quality because of late or incomplete information, access to the ship is restricted due to conflict with operational schedules, and each overhaul is treated virtually as if a ship had never been through an overhaul before.

These problems are addressed by the pre-arrival conference, where members of the ship, TYCOM, PERA, Supervisor of Shipbuilding, Conversion, and Repair (SUPSHIPS is the group that does contract administration and accepts work for the government), and the IMAs bring out problems within the SARP. Conflicts over who should do certain work because of either the scope of the work or expertise required are resolved. Problems with omission of jobs, as well as problems with improper job descriptions or misunderstood job descriptions, are corrected.

The output of this process is a reliable SARP that can be used to solicit bids from contractors and to begin the initial planning. From this effort, the ship has a baseline from which to proceed into the detailed planning of the overhaul, including the baseline for the planning and implementation of the FMS-RT system. It is critical to realize that the FMS-RT system only tracks ship's force work and work screened to IMAs, that is, work to be done by the Navy, *not* contractor work.

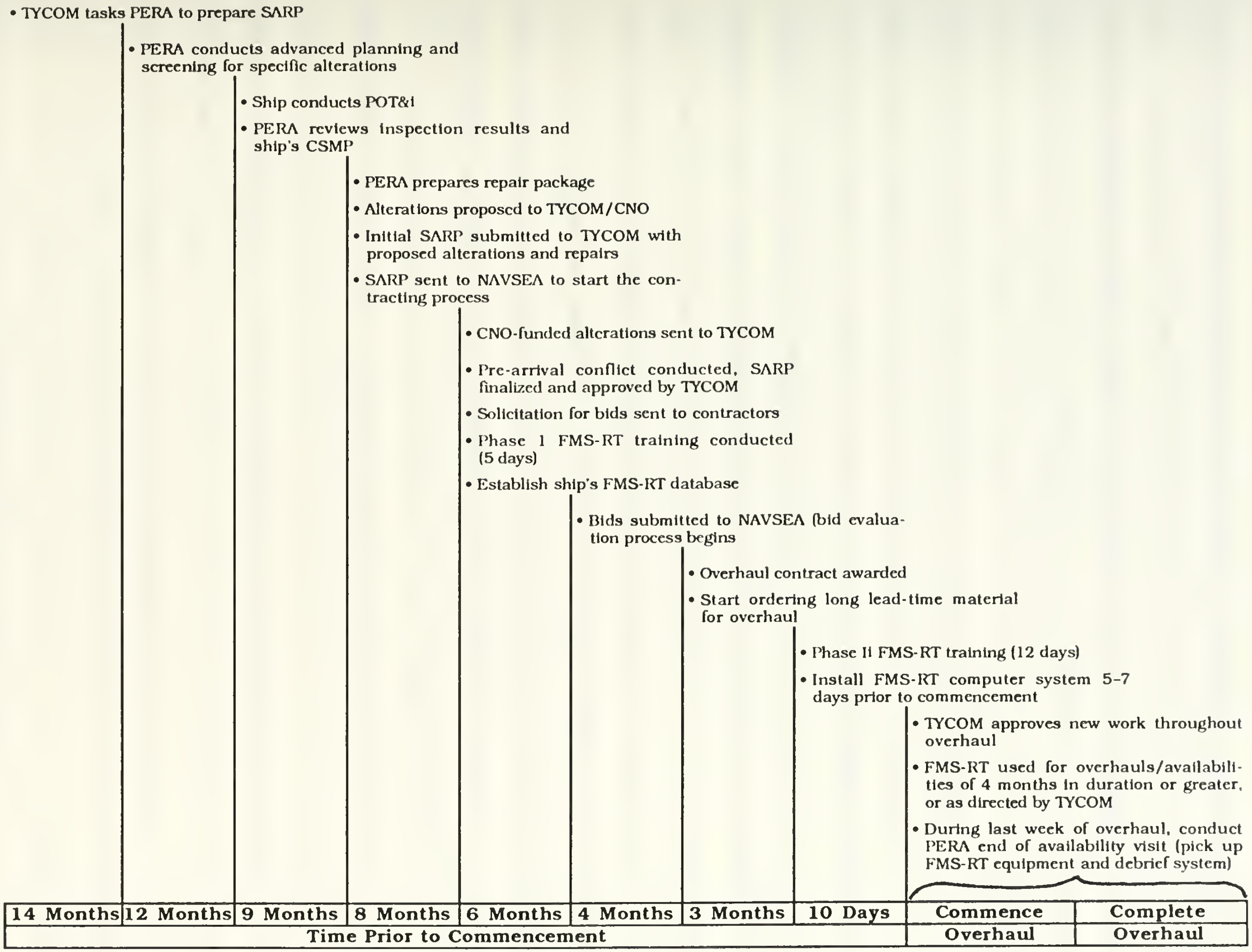
Figure 2 is a summary time line of the overhaul process. This time line varies slightly depending on the type of overhaul or availability and the ship type.

B. BACKGROUND OF OLD MANAGEMENT SYSTEMS AND PROBLEMS

1. Manual Ship's Force Tracking System

This system refers to the non-automated tracking system used by ships prior to the Ship's Force Overhaul Management System (SFOMS) that will be discussed later in this chapter. This manual system is hard to describe because it varied from ship to ship and the overhaul process was different than it is today. The ships' personnel worked in conjunction with the shipyard. They were tasked with jobs by the contract administrator, SUPSHIPS, and most overhauls were conducted at Navy shipyards.

Today, more work is contracted out to private contractors. The Office of Management and Budgeting Circular Number A-76 [Ref. 4] established the policy of not having the government compete over contracts that can be accomplished by commercial sources. This policy emphasizes having commercial activities do as much as possible so the size of our military force can be controlled and so we can train our military to meet their primary mission. Contracts are also given to create and maintain a strong base of shipbuilding and ship repair facilities in case of mobilization. We hold the commanding officer of the ship responsible for the overhaul and the employment of



- TYCOM tasks PERA to prepare SARP
- PERA conducts advanced planning and screening for specific alterations
- Ship conducts POT&I
- PERA reviews inspection results and ship's CSMP
- PERA prepares repair package
- Alterations proposed to TYCOM/CNO
- Initial SARP submitted to TYCOM with proposed alterations and repairs
- SARP sent to NAVSEA to start the contracting process
- CNO-funded alterations sent to TYCOM
- Pre-arrival conflict conducted, SARP finalized and approved by TYCOM
- Solicitation for bids sent to contractors
- Phase 1 FMS-RT training conducted (5 days)
- Establish ship's FMS-RT database
- Bids submitted to NAVSEA (bid evaluation process begins
- Overhaul contract awarded
- Start ordering long lead-time material for overhaul
- Phase II FMS-RT training (12 days)
- Install FMS-RT computer system 5-7 days prior to commencement
- TYCOM approves new work throughout overhaul
- FMS-RT used for overhauls/availabilities of 4 months in duration or greater, or as directed by TYCOM
- During last week of overhaul, conduct PERA end of availability visit (pick up FMS-RT equipment and debrief system)

Figure 2. **General Overhaul Time Line**

his resources, both financial and personnel. Prior to 1975, when this system was put in place, overhauls were done by naval shipyards with the crew and the shipyard personnel working together. The commanding officer of the ship and the project manager of the overhaul worked closely to coordinate the work to be done in the overhaul.

The manual system was either set up by the ship or, in some cases, the shipyard would provide a work plan to the ship in the form of a PERT or CPM-type chart. Turban and Meredith [Ref. 5:pp. 319-377] explain the general concepts of program management. PERT is the Program Evaluation Review Technique and CPM is the Critical Path Management Technique. The difference between these two program management techniques is the way in which activity durations are estimated. PERT utilizes a form of weighted average or a probabilistic approach and CPM uses only one estimate for duration of an activity. In addition, CPM allows an explicit cost estimate in addition to time. PERT is basically a tool for planning and controlling time.

As Turban and Meredith point out, PERT and CPM force management to plan in detail and to define what must be done to insure timely completion of the project. These techniques are easily understood because they provide a method of visualizing the entire project. The Navy requires submission of either a PERT or CPM plan with bids from contractors on ship overhauls (see reference for further details).

A problem with the manual system is that the unit going through overhaul has little control over the format of information. Each contractor or shipyard had its own system for job tracking. The ships had different tracking methods internally. The internal systems sometimes changed from department to department or from division officer to division officer. Some ships had them on pocket notebooks, others had standard forms made up for tracking purposes. In short, there was no standard established in the Navy—internal reports could be standardized if the command emphasized standardization. However, internal and external reports were not standard, making decision making and problem identification very difficult. These information-handling differences often caused duplication of effort, which drove up the cost of overhauls and increased their duration.

We still see the use of manual tracking today as a back-up to the current computer-based systems used in the Navy. While aboard USS Hewitt, the engineer tracked key jobs for his pocket notebook (wheelbook) and had standard forms for each ship's force job in his department; these were updated twice a week. He had this manual tracking system because his forms had a remarks column with more detailed information than the reports generated by the computer-based system.

2. The Ship's Force Overhaul Management System

In 1975, Pearl Harbor Naval Shipyard initiated an Overhaul Improvement Program. The goal of the program was to make more efficient use of resources (personnel and money). After a review of the maintenance data available at the time and 12 alternatives for a management information system (MIS) that could track ship's force work,the SFOMS tracking system was adopted. The purpose of this system was to eliminate the duplication of effort and to make more efficient use of ship's force personnel. The end result, one hoped, would be an overhaul of shorter duration and at a cheaper cost to the government.

The system was a batch data-processing system. The database was updated weekly using a transaction file. The system was designed using a central host computer (mainframe computer), feeding changes from a microcomputer through the use of the Computer Systems Corporations Information Network (INFONET), the backbone telecommunications network.

The problem with the SFOMS system was that, as of 1 January 1988, the Navy stopped utilizing the INFONET. Additionally, reports were frequently late because of the usual process of submitting a single request for an update with reports. Up-to-date reports and an updated database could only be obtained by request. The process consisted typically of submitting the updates on Friday. The database was first updated and then the reports were produced and delivered to the ship. This report turnaround process meant that changes needed to be in by Thursday, and reports would be back to middle management by Tuesday, thus allowing just three days for problem identification, scheduling corrections, and other decision-making processes.

Problems with data correctness also existed because only weekly updates were available. In addition, the report formats did not answer all the questions that the commanding officer had and there was no "what if" query capability. The inputs were substantially driven by paperwork. The input forms were filled out and submitted for review up the chain of command, with only one or two people inputting changes to the database. This allowed forms to be lost or data to be entered incorrectly. The system was complex, functional, and cumbersome. However, the major reason for its downfall was the loss of the INFONET and the emergence of powerful microcomputer-based systems that could do the same job in a stand-alone capacity.

3. Problems Computer-Based Systems Must Overcome

In the area of computer-based tracking systems for ship's force work, there are two problems—infrequent use and system complexity. Ships go through overhauls and other industrial availabilities based on a maintenance cycle for the particular class of ship. These major upkeep periods are every three to five years. Therefore, we use this computer tracking system very infrequently. Because we do not utilize the system regularly, we must be trained on the system before we can be expected to utilize it efficiently and effectively.

Additionally, the person who interfaces directly with the computer is not trained on computers and has other responsibilities aboard ship. For the most part, Navy ships do not have people trained int eh use of microcomputers. Were we to stereotype the user, we would say he was a responsible Second Class Petty Officer up to a Chief

Petty Officer; he is not in charge of a work center; he has a background in electronics, and he has only an "average American knowledge" of using a computer. He did not get formal training on computers prior to using this system, and he does not own his own personal computer. He has no programming skills. In short, he has a limited knowledge of computers.

Therefore, we cannot have complex systems that are not easy to use. Our system needs to be extremely forgiving and very "user-friendly."

III. DESCRIPTION OF FMS-RT

A. HARDWARE

The FMS-RT system was designed to operate on an AT-compatible microcomputer that consists of the following:

- an AT keyboard layout
- a minimum of 20 megabytes of internal fixed disk (access time of 40 MS or less)
- a 360-kilobyte diskette drive
- a high-resolution composite graphics monitor
- a Hercules-compatible composite color video card
- a graphics-capable printer (minimum 200 CPS)
- a minimum of one megabyte of memory (expandable to 2.6 megabytes)
- a tape streamer back-up
- an internal date and time clock (battery powered/back-up)
- MS-DOS version 2.1 or greater
- an asynchronous communications interface
- an 80287 math co-processor
- a serial port (one)
- a parallel port (one)
- two 8/16 bit expansion slots (unused)
- an IBM-compatible graphics card
- an electrical surge supressor

Generally speaking, FMS-RT uses the Zenith-248 computer with Zenith monitors and keyboards and the Alps-P2000G or P2100G printer.

B. SOFTWARE

The program life-cycle manager for the software is Naval Sea Systems Command Automated Data Systems Activity (SEAADSA). The software was programmed in the high-level computer language COBOL (Common Business Oriented Language). COBOL's strength is in business applications and it interfaces well with other languages. Since FMS-RT is a project-management tool, COBOL is an understandable programming language selection.

The software consists of eight standard five and one-quarter inch (5.25") floppy disks (double sided, double density). The disks contain 156 fils. The files are functional processes, which indicates that the software used a modular design concept. Also, the file sizes and order indicate that during design, functional decomposition was utilized to break processes down into programmable modules.

The use of 156 files will make debugging, troubleshooting, and enhancements very difficult due to the large number of module interfaces. A change to one module will require investigation into the impact of that change on all the modules with which the module to be changed interacts. This means a great deal of testing will be done to verify the impact of software changes.

The software has limited sort features. The user can only get sorted information on selected fields, not on any field of his choice. This prohibits user query capability and "what if"-type questions.

For further descriptive information on the FMS-RT system, readers should consult the FMS-RT Operator's Guide [Ref. 6].

C. THE SYSTEM

FMS-RT was introduced to the fleet on 1 January 1988. It was designed as a portable stand-alone management information system (MIS). The purpose of the system was to track ship's force work during overhauls and availabilities.

A portable stand-alone system means that the computer system is not linked to other systems via a network and the computer system is controlled by the user at the installation site. The real-time part of FMS is that updates and report generation can be done anytime the unit chooses. It does not use the typical computer terminology definition of real time, which is that the output of the computer is severely time constrained, so the computer processing time must be extremely efficient to meet the time constraint of obtaining output. An example of this is a fire control solution for a weapons system, which must be real-time processing to be of any value.

The basic process in computer operations in input-process-output. This means that when a computer is operating and given an input, a process is triggered which has the computer manipulate data and it produces an output. The top of Figure 3 illustrates this principle.

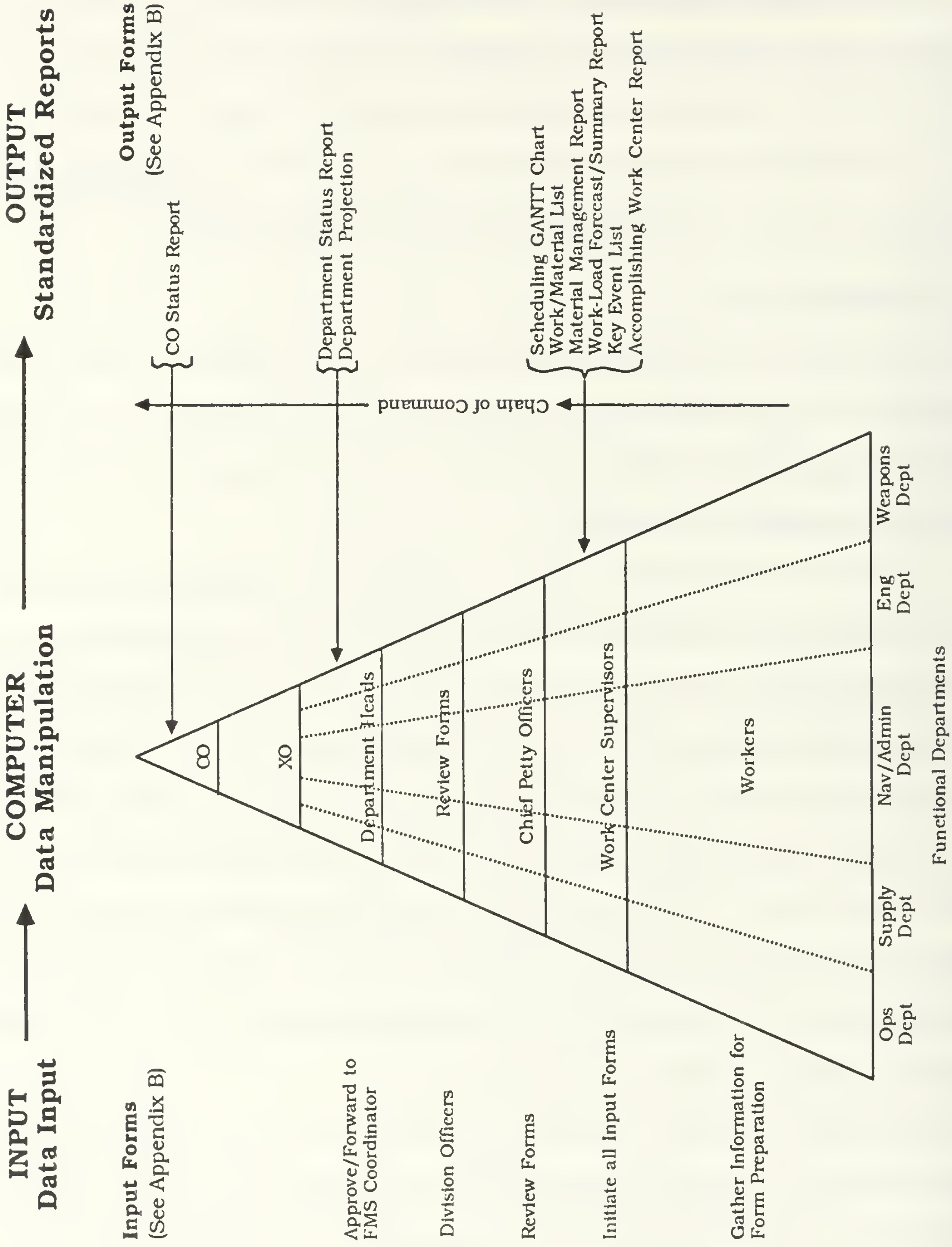


Figure 3. **FMS-RT Described by Head's MIS Triangle**

Why is FMS-RT an MIS? What is an MIS? A triangle was used by Robert Head in the late 1960s as a visual model to characterize MIS in a broad, comprehensive sense [Ref. 7]. MIS characteristics include an information focus aimed at the middle-level managers, structured information flows, an integration of low-level electronic data-processing functions, and inquiry and report generation, usually with a database. These are the same characteristics found in the FMS-RT system. Figure 3 uses Head's triangle.

The vertical axis indicates the level of management (in our figure, the chain of command). The horizontal axis indicates functional departments. The figure illustrates that there is a structured flow of information. The flow proceeds up the chain of command to the department-head level before being entered into the FMS-RT systems. The systems process the input data and the figure illustrates that most output repots are aimed at the middle-level manager. Structured flow of information aimed at middle-level managers in report form is characteristic of MISs. Many low-level data-processing functions are invoked to manipulate the data. For these reasons, we see the FMS-RT system as an MIS.

The input and output forms referred to in Figure 3 are found in the FMS-RT Administrative Manual [Ref. 8] and copies are provided for the reader in Appendix B.

In summary, FMS-RT can be described as a project management tool. A project management tool tracks many independent job activities by sequencing those that require sequencing and tracking them

In summary, FMS-RT can be described as a project management tool. A project management tool tracks many independent job activities by sequencing those that require sequencing and tracking them all from start to finish. FMS-RT tracks ship's force jobs from the start of the overhaul to completion. It links jobs to key events in the overhaul process. For example, if job A needs to be done while the ship is in drydock, and docking and undocking the ship are key events, then job A will be linked to the key event of undocking the ship so that any attempt to schedule job A after undocking receives a flag to indicate that there is a problem with the proposed change.

IV. METHODOLOGY

A. DESIGN

The two research questions are “To what extent does the curriculum teach people to efficiently and effectively utilize the FMS-RT system? and “To what extent is the FMS-RT system usable by the end user? In this section, we will lay out what data were collected to answer these questions. We will begin with the training curriculum content.

A way to measure training content is to do a comparative analysis of the current curriculum and an ideal curriculum. There were four steps in this type of research design. First, the current curriculum content was ascertained by interviewing the trainer and by having the researcher participate in the training program. A comparison of the two reports—one from the trainer and one from the researcher—revealed no differences in the content of the training program. Second, three experts were identified: an expert from within the Navy, an expert from outside the Navy, and an expert from SUPSHIPS who is the Navy-to-contractor interface. Third, through a structured interview process, the experts described what they consider the ideal curriculum content to be. The last step was a comparison of what the experts identified as the ideal curriculum and what the researcher and trainer identified as the current curriculum.

There are three steps in the research design to evaluate the software usability. First, since the users were geographically dispersed, the researcher decided to survey major users. Second, the survey was constructed. The survey was modeled after Baroudi and Orlikowski's short-form measure of user information satisfaction [Ref. 9]. This survey was used because Baroudi and Orlikowski demonstrated that the survey form used valid measures (the 13 factors had Cronbach's alpha at .84 and above).

In our survey, the first two questions establish the level in the chain of command of the user and his experience in the overhaul process. Questions 3 through 10 are the seven factors from Baroudi and Orlikowski's survey that applied to the FMS-RT system. We chose only the seven that applied to the use of the system and rejected the six factors relating to the system design because our users were not involved in design. Questions 11 through 17 are specific to FMS-RT: Question 11 measures the average number of changes in data per week, Questions 12 through 16 are specific "yes or no" type questions regarding already-planned enhancements and the usefulness of the FMS-RT system, and Question 17 is an overall evaluation of the FMS-RT system. Question 18 is used to determine on which coast the training was conducted. [PERA (CRUDES) is responsible for training, but currently contracts it out to Envision Corporation in Chula Vista, California, for all west-coast (COMNAVSURFPAC) ships and to Stellar Corporation in Norfolk, Virginia, for all east-coast

(COMNAVSURFLANT) ships.] Question 19 is an open-ended question regarding enhancements or problems with FMS-RT.

A copy of the cover letter to the commanding officers of the ships to be surveyed, the cover letter to the participants, and the survey are contained in Appendix C.

B. SAMPLE

Who do we sample to get this data? To evaluate the training curriculum, we sample the experts. To evaluate the usability, we survey a sample of commands that have utilized the FMS-RT system.

To ascertain the ideal training curriculum, we sought three points of view: a view from within the Navy, a view from outside the Navy (outside contractor), and a view from the interface between the Navy and the outside (SUPSHIPS). In addition, since experience was a factor, we defined an expert as a person who had spent a minimum of three years in an overhaul management environment.

There are numerous people who fit these requirements. Therefore, since we wished to interview them, we added the constraint that the expert had to be on the west coast (because of travel time and funding constraints). Three people met these requirements:

1. CDR Loeffler, Commanding Officer, USS Hewitt (DD-966), presently half-way through an overhaul. He has used SFOMS and FMS-RT, and has been through ten major industrial availabilities or overhauls.

2. Mike Rose, Project Manager for Continental Maritime of San Diego (CMSD). He was an engineering division officer during a carrier overhaul, resigned from the Navy, and has handled six or seven projects for CMSD.

3. Robert Cordell, SUPSHIPS Project Manager presently responsible for the overhaul of USS Hewitt. He is a GS-12 who has worked on ship overhauls as a member of the Navy and who, after getting out, went to work for SUPSHIPS as a surveyor and progressed up to project manager.

Who do we sample in our usability survey? The commands surveyed came from a list of cruiser-destroyer (CRUDES) type ships provided by the sponsor of this research, PERA (CRUDES). The list consisted of 26 ships that, as of June 22, 1988, were currently using or had recently finished using the FMS-RT system. Ten survey forms were sent to each command to get a cross-section of responses from their users. Because FMS-RT is relatively new, 26 CRUDES ships are all that have utilized the system. Other ship types use FMS-RT, but this study was directed at only CRUDES-type ships.

To avoid the requirements of the Privacy Act and to get the true feelings of the users, our survey was sent to the commands. The command was tasked with choosing those people who directly interface with the computer and those who utilize the input and output reports. Since the command knows who uses the system the most, the selection of survey participants was left up to the command and names were not requested.

C. DATA COLLECTION

The collection of data on the training curriculum involved the following steps:

1. The researcher collected a generic training curriculum outline from PERA (CRUDES) that they utilized in evaluating contractor personnel on performance of the training contract.

2. After review of the overhaul process and training curriculum outline, the researcher scheduled a visit to USS Jarrett (FFG-33) for Phase I FMS-RT training.

3. The researcher participated in Phase I FMS-RT training aboard USS Jarrett (FFG-33) from June 13, 1988 to June 16, 1988. During this time, the researcher interviewed the trainer, Robert Jackson of Envisions Corporation, on the content of the training curriculum in both Phases I and II [Ref. 10]. The researcher did not participate in Phase II FMS-RT training but covered it during the interview.

4. The researcher obtained a copy of all training documentation provided to the ship from Mr. Jackson.

5. From this documentation, the researcher prepared questions for the expert interviews. The questions follow:

    a. What is your experience in ship overhauls? How many?

    b. Based on your experience, what topics do you feel need to be covered in an ideal training curriculum? Be specific—for example, how you scope a job or the cost and time constraints the unit must meet.

    c. Do you have any opinion on current Navy training curriculums? If so, are you familiar with FMS-RT or SFOMS? If yes, can you give the strengths and weaknesses of their training curriculums?

    d. How important is project management in a training curriculum? At what level in the chain of command should it be taught, if it is important?

    e. The emphasis of these questions is to create an ideal training curriculum for using the Navy's FMS-RT system and help ships perform more efficiently an effectively during an overhaul environment. What components of a curriculum do you feel are essential?

    f. Is there anything else you have experienced that could be used to improve FMS-RT? Any training you have seen that was better than what the Navy has now?

6. The researcher conducted the expert interviews [Refs. 11–13].

Data collection for the user survey involved the following steps:

1. The researcher prepared the survey in early June.
2. A pilot survey was run on ten users aboard USS Hewitt (DD-966) on June 17, 1988. The respondents encountered no problems in understanding the survey questions.
3. The researcher received a listing of ships that have used FMS-RT from PERA (CRUDES). Of the 26 ships on the list, since the USS Hewitt was done as a pilot, 10 surveys were produced for each of the remaining 25 ships.
4. Responses were accepted until August 30, 1988. The total number of respondents to the survey was 120. Of these 120, ten were from the pilot and 11 out of the remaining 25 commands responded with 110 surveys. Of the 14 commands that did not return surveys, two commands reported never using FMS-RT. Therefore, 260 surveys were prepared (10 for each of 26 commands). 20 surveys were sent to two commands that never used FMS-RT. This yielded 240 active surveys sent; 120 were received for analysis.

The administration procedure for the survey requested command participation. Therefore, participation by the command was voluntary. The surveys were handled at a command level, meaning they were sent to the command, handed out, and returned by the command. Names were not asked for on the survey and an explanation of the survey's use was provided to help solicit actual user feelings. No pressure was placed on the command to participate or to accelerate the data collection effort. For example, no follow-up message was sent, no direction from higher levels in the chain of command was sent, and no due date was imposed. We suspect that these were the reasons the response rate was only 50 percent (120 responses out of 240 active surveys).

V. RESULTS

A. CURRENT CURRICULUM

The FMS-RT training content combines general concepts in project management with specific training in preparing information to be input into the FMS-RT system. Phase I FMS-RT training is five days in duration and scheduled about six months prior to the commencement of the overhaul. The training is conducted at the ship. The topics covered in Phase I follow:

1. Each work center is provided a copy of the FMS-RT Work Center Supervisor User's Booklet [Ref. 14].

2. Industrial work (man-hours) is defined as man-hours relating directly to overhaul work. Non-industrial work is time spent not on overhaul work, like paperwork, watch standing, leave, schools, and other non-overhaul-related items. In the content of this topic, historic data from past ships shows the relationship between industrial man-hours versus non-industrial man-hours. For example, a work center usually has a 40 percent/60 percent split. This indicates that in an eight-hour work day, 40 percent of a worker's time is spent on industrial work and 60 percent is spent on non-industrial work.

3. The Work Load Forecast and Summary Report and the Manpower Planning Form (both forms found in Appendix B) are presented and each field is explained. Manpower is presented as a constrained resource that must be managed. The last day of Phase I training requires each work center to submit a Manpower Planning Form; turn-in procedures and use of the forms is explained. The forms are used to establish an initial ships database.

4. Job scoping identifies the jobs for the ship's force work package (SFWP). The jobs for this package come from the ship's CSMP, the SARP, and other jobs the ship delineates. Job scoping breaks jobs down into steps accomplishable by one work center, called key operations (KEYOPS or KOP). The difference between originating work center (OWC) and accomplishing work center (AWC)

is explained. (An OWC starts a job and is responsible to see the job through to completion. An AWC is responsible for a particular KEYOP, not the whole job.)

5. Each field and the use of the FMS-RT Input Form, Work List Form, and Work List/Material Form are explained to the user. (All forms are found in Appendix B.)

6. Phase I training concludes with the trainer explaining that FMS-RT is a dynamic system and changes can be made to all inputs. The trainer receives Manpower Planning Forms from each work center and arranges with the ship to send an initial list of jobs to him on FMS-RT Input Forms. These jobs are usually sent to the trainer about 30 days after Phase I training is complete. The trainer ends Phase I training by arranging with the command tentative dates for Phase II training, arranging a date for the initial set of FMS-RT Input Forms to be mailed, and arranging an FMS-RT coordinator from within the ship to collect and disseminate FMS-RT information and documentation. The trainer leaves about 10 copies of the FMS-RT Administrative Manual [Ref. 8] for command planning purposes to end Phase I training. The Administrative Manuals explain the overhaul process, the key players' responsibilities, staffing modifications, and other helpful information.

Phase II training is 10 to 12 days in duration. However, Phase II training has been split into two parts provided that the government incurs no more costs than if it were conducted in one session. Phase II training is conducted aboard the ship. Phase II training consists of the following:

1. Review of Phase I topics.

2. The Scheduling Gantt Chart (found in Appendix B) is explained as a time management tool. Each field on the form and its purpose are explained to the users.

3. Scheduling work is a broad topic. Scheduling entails the time it takes to do the activity (an estimate), time for quality assurance (QA), and a buffer or cushion. Scheduling must consider shipyard key events that may affect a job. The trainer explains how to build a buffer or cushion into jobs that must be done either prior to or in conjunction with a key event in the overhaul schedule. A

reminder is given to work center supervisors to pay attention to man-hours available to do industrial work.

4. Balancing work involves even distribution of jobs based on the available man-hours from week to week.
5. A second package of work on FMS-RT Input Forms is given to the trainer to add to the current ships database.
6. Phase II training concludes with the trainer explaining that job estimates will be frozen at some point after the beginning of the overhaul. The trainer arranges a tentative date to bring the hardware and software to the ship and to train those people who will interface directly with the system.

B. OPTIMAL CURRICULUM

The optimal curriculum content was identified by three experts. Table 1 illustrates the questions asked each expert down the left side and the responses given by each expert across the top. The interviews were structured, so "N/A" indicates that the question is not applicable to that particular expert either because he had no experience in that area on which to base an answer or because the question was not relevant to that expert.

C. USABILITY SURVEY RESULTS

In our survey of users, we received 120 responses. Table 2 breaks down the respondents by their position in the chain of command and their experience in overhauls. Questions 1 and 2 in our survey ask for the user's position in the chain of command and how many major overhauls the user has gone through. In Table 2, positions are listed in the left column with the number of respondents and the number of major overhauls split into the mode response and the range of responses.

TABLE 1

EXPERT INTERVIEWS

	Respondent		
Questions	**Expert #1** CDR Loeffler CO, USS Hewitt [Ref. 11]	**Expert #2** Robert Cordell SUPSHIPS Proj. Mgr. [Ref. 12]	**Expert #3** Mike Rose CSMD Project Manager [Ref. 13]
1. What is your experience in ship overhauls?	About 5 SRAs; 2 overhauls as a junior officer. Presently CO of a ship in overhaul. About 3.5–4 years in overhaul experience.	Project manager for 3 navy ship overhauls. Ship surveyor for 4 years. 2 major availabilities while in the Navy. About 15 years of overhaul experience.	1 con while in the Navy. 6–7 ships overhauled at CMSD, 3 of which were Navy ships. 6 years experience.
2. Are you familiar with computer-based project management tools? If so, which ones?	Yes, SFOMS and FMS-RT. We used what I think was called PERT on my first overhaul back in 1979.	I'm familiar with SFOMS. The new FMS-RT I'm not real familiar with, but I know it's in the fleet.	Yes, SFOMS we used in the overhaul of the carrier. At CMSD, we use a Harvard project manager tool.
3. Have you gone through any training courses on how to use these tools?	Yes, I went through SFOMS training and read the FMS-RT administrative manual.	No, I haven't been through formal training on these systems, but I see a lot of the output from contractors and the Navy.	I was trained on the Navy SFOMS, but at CMSD we have a group that updates our PERT charts.
4. Based on your experience, what topics do you feel should be covered in an ideal training curriculum for an overhaul?	1. Job identification—what jobs need to be done during the overhaul, how to find jobs that need to be done. 2. Time available or manpower. How many people can I put to work each day?	I feel four things are important. You need to know the work that needs to be done. You need to know how long it takes to get done. You have to know all your restrictions like when you pull out of dock and when your overhaul is	Responsibilities of everyone involved. • Any restrictions such as money, time, material, etc. • How to do good estimation of activity duration, either through a weighted average, subcomponents,

Questions	Respondent		
	Expert #1	Expert #2	Expert #3
	3. How to estimate work. SFOMS/FMS-RT do a good job on this part. Break down a job into sub-parts and get a better estimate. 4. Big-picture items like key events in the overhaul, cost constraints, and time constraints. 5. Management techniques like critical path to control cost and time. 6. Sound scheduling techniques.	over. Finally, you must have a way to manage that. I think division officers and department heads need to be taught project management techniques like PERT, CPM, and the use of Gantt charts. The key to success is understanding the process and controlling it. Otherwise, the process will control you.	or past experience. • How to schedule based on material lead time, critical events, and manpower available. • Know how to scope a job to do good estimating and material planning.
5. What is your opinion of Navy training content?	Well organized. It covers the essentials. It is up to the commands to establish policies, controls, and other information needed to be successful.	N/A	From what I remember of SFOMS, it was adequate but too fast. Overhaul is an infrequent event on a ship so you must take time to prepare your people.
6. How important is project management training in a curriculum?	Essential.	Very important.	Critical, especially if you are profit motivated.
7. At what level in the chain of command should it be taught? ("it" refers to management training).	Department heads drive their division officers. I think department heads should learn this as part of SWOSCOL department head course and teach their JOs.	It would be nice if everyone knew Pert, CPM, etc. I think department heads and CPOs should either know them or have acquired them.	I think division officers should be taught project management techniques at SWOS Basic school because they are applicable to many officer functions.
8. The emphasis of these questions is to create an ideal training curriculum for using the Navy's FMS-RT. Do you have any other comments you feel should be in this curriculum?	Yes—specifics on the system. I know the training my men received was good, because those who were unable to attend could learn from their peers and the manuals. Good manuals are very important in the Navy.	No, just what I said before.	No, but the Navy has a weakness. That is, when we train we don't identify the levels we wish to train and adapt the content to the level. The method of training and content must be geared for the people we train. When I was in the Navy, most times the training was either over my head or so low that I fell asleep.

TABLE 2

RESPONDENT PROFILE

Position in Chain of Command		# of Respondents	# of Major Overhauls	
			Mode	Range
Division Officer		36	1 (22)	1-2
Chief Petty Officer (E7-E9)		22	2 (14)	1-6
Work Center Supervisor		42	1 (30)	1-3
FMS-RT Data Processor		12	1 (12)	N/A
Others:	1 FMS-RT Coordinator	4*	2 (3)	1-2
	2 Department Head	3	2 (2)	1-2
	3 Commanding Officer	1	4 (1)	N/A

n = 120

* 3 of 4 FMS-RT Coordinators are Department Heads; 1 was an E-8.

"Mode" indicates the most frequently occurring value in a group of responses; the number in parentheses is the number of people who gave that response. For example, of the 120 surveys, 36 respondents were division officers. Twenty-two (22) of the 36 division officers responded that they had been through one major overhaul and the range of responses was one to two overhauls. N/A indicates that range is not applicable because all respondents gave the mode response.

Questions 3 through 9 describe different usability components. The components have two descriptive scales for each question. Using one table per question, we list each scale and provide the percentage of respondents who selected each description; we put the actual number of respondents in parentheses. The anchors range from one extreme to an opposing extreme. The respondents are broken down by position across the top of the table with an overall percentage based on all respondents.

TABLE 3

DEGREE OF TRAINING

Question 3: Degree of training provided on the FMS-RT and overhaul process:

Scale	Division Officer (n-36)	CPO (n-22)	WCS (n-42)	FMS-RT Data Processor (n-12)	Others (n-8)	Overall (n-120)
Extremely complete	5.5%(2)	0% (0)	4.7% (2)	0% (0)	0% (0)	3.3% (4)
Quite complete	25% (9)	22.7% (5)	23.7%(10)	16.7%(2)	12.5%(1)	22.5%(27)
Slightly complete	50% (18)	54.5%(12)	50% (21)	75% (9)	62.5%(5)	54.2%(65)
Equally complete/ incomplete	5.5%(2)	0% (0)	4.7% (2)	0% (0)	12.5%(1)	4.2% (5)
Slightly incomplete	5.5%(2)	0% (0)	2.4% (1)	8.3%(1)	0% (0)	3.3% (4)
Quite incomplete	5.5%(2)	13.6% (3)	14.5% (6)	0% (0)	12.5%(1)	10% (12)
Extremely incomplete	3% (1)	9.2% (2)	0% (0)	0% (0)	0% (0)	2.5% (3)
Extremely superior	5.5%(2)	4.5% (1)	0% (0)	0% (0)	0% (0)	2.5% (3)
Quite superior	5.5%(2)	0% (0)	4.7% (2)	8.4%(1)	0% (0)	4.2% (5)
Slightly superior	16.6%(6)	9.0% (2)	28.8%(12)	25% (3)	37.5%(3)	21.7%(26)
Equally superior/ inferior	33.3%(12)	59.5%(13)	42.8%(18)	50% (6)	50% (4)	44.2%(53)
Slightly inferior	25% (9)	18% (4)	9.5% (4)	8.3%(1)	12.5%(1)	15.8%(19)
Quite inferior	14.1%(5)	4.5% (1)	9.5% (4)	8.3%(1)	0% (0)	9.1%(11)
Extremely inferior	0% (0)	4.5% (1)	4.7% (2)	0% (0)	0% (0)	2.5% (3)

TABLE 4

UNDERSTANDING OBJECTIVES

Question 4: User's understanding of the objectives of the FMS-RT:

Scale	Division Officer (n-36)	CPO (n-22)	WCS (n-42)	FMS-RT Data Processor (n-12)	Others (n-8)	Overall (n-120)
Extremely sufficient	0% (0)	0% (0)	2.4% (1)	0% (0)	0% (0)	0.8% (1)
Quite sufficient	8.3% (3)	4.5% (1)	4.7% (2)	0% (0)	0% (0)	5% (6)
Slightly sufficient	8.3% (3)	9% (2)	4.7% (2)	8.4%(1)	0% (0)	6.7% (8)
Equally sufficient/ insufficient	25% (9)	46% (10)	28.8%(12)	33.3%(4)	12.5%(1)	30% (36)
Slightly insufficient	16.7% (6)	27% (6)	9.5% (4)	33.3%(4)	12.5%(1)	17.5%(21)
Quite insufficient	16.7% (6)	13.5% (3)	26.2%(11)	25% (3)	81% (6)	24.1%(29)
Extremely insufficient	25% (9)	0% (0)	23.7%(10)	0% (0)	0% (0)	15.9%(19)
Extremely complete	11.1% (4)	18% (4)	2.4% (1)	0% (0)	0% (0)	7.5% (9)
Quite complete	16.7% (6)	32.2% (7)	21.4% (9)	25% (3)	25% (2)	22.5%(27)
Slightly complete	38.8% (6)	27.2% (6)	23.3%(10)	8.4%(1)	50% (4)	22.5%(27)
Equally complete/ incomplete	16.7%(14)	13.6% (3)	38.8%(16)	58.2%(7)	25% (2)	35% (42)
Slightly incomplete	16.7% (6)	0% (0)	4.7% (2)	0% (0)	0% (0)	6.7% (8)
Quite incomplete	0% (0)	9% (2)	4.7% (2)	0% (0)	0% (0)	3.3% (4)
Extremely incomplete	0% (0)	4.5% (0)	4.7% (2)	8.4%(1)	0% (0)	2.5% (3)

TABLE 5

UNDERSTANDING OBJECTIVES

Question 5: User's feeling of participation in the overhaul management process by using this system:

Scale	Division Officer (n-36)	CPO (n-22)	WCS (n-42)	FMS-RT Data Processor (n-12)	Others (n-8)	Overall (n-120)
Extremely positive	11.1% (4)	0% (0)	0% (0)	8.4%(1)	0% (0)	4.2% (5)
Quite positive	11.1% (4)	0% (0)	9.5% (4)	33.3%(4)	100% (8)	16.6%(20)
Slightly positive	25% (9)	9% (2)	31% (13)	33.3%(4)	0% (0)	23.3%(28)
Equally positive/ negative	33.3%(12)	37% (8)	50% (21)	25% (3)	0% (0)	36.6%(44)
Slightly negative	19.5% (7)	22.5% (5)	2.4% (2)	0% (0)	0% (0)	11% (13)
Quite negative	0% (0)	13.5% (3)	2.4% (1)	0% (0)	0% (0)	3.3% (4)
Extremely negative	0% (0)	18% (4)	4.7% (2)	0% (0)	0% (0)	15% (6)
Extremely sufficient	5.5% (2)	9.2% (2)	2.4% (1)	0% (0)	0% (0)	4.2% (5)
Quite sufficient	0% (0)	40.9% (9)	0% (0)	0% (0)	0% (0)	7.5% (9)
Slightly sufficient	11.1% (4)	31.8% (7)	0% (0)	16.6%(2)	0% (0)	10.9%(13)
Equally sufficient/ insufficient	11.1% (4)	18.1% (4)	48% (2)	58.4%(7)	12.5%(1)	15% (18)
Slightly insufficient	33.3%(12)	0% (0)	21.4% (9)	25% (3)	62.5%(5)	24.1%(29)
Quite insufficient	22.3% (8)	0% (0)	71.4%(30)	0% (0)	25% (2)	33.3%(40)
Extremely insufficient	16.7% (6)	0% (0)	0% (0)	8.4%(1)	0% (0)	5% (6)

TABLE 6

ATTITUDE TOWARD FMS-RT

Question 6: Attitude toward using FMS-RT:

Scale	Division Officer (n-36)	CPO (n-22)	WCS (n-42)	FMS-RT Data Processor (n-12)	Others (n-8)	Overall (n-120)
Extremely cooperative	5.5% (2)	4.5% (1)	0% (0)	8.3%(1)	0% (0)	3.3% (4)
Quite cooperative	25% (9)	13.5% (3)	14.3% (6)	16.8%(2)	12.5%(1)	17.5%(21)
Slightly cooperative	50% (18)	9% (2)	19% (8)	25% (3)	0% (0)	25.8%(31)
Equally cooperative/ belligerent	8.3% (3)	50% (11)	38% (16)	25% (3)	62.5%(5)	31.6%(38)
Slightly belligerent	2.8% (1)	18.5% (4)	14.3% (6)	8.3%(1)	0% (0)	10% (12)
Quite belligerent	5.5% (2)	0% (0)	7.2% (3)	8.3%(1)	25% (2)	6.8% (8)
Extremely belligerent	2.9% (1)	4.5% (1)	7.2% (3)	8.3%(1)	0% (0)	5% (6)
Extremely negative	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)	0% (0)
Quite negative	0% (0)	13.5% (3)	7.2% (3)	0% (0)	0% (0)	5% (6)
Slightly negative	11.1% (4)	22.7% (5)	14.3% (6)	0% (0)	25% (2)	14.1%(17)
Equally negative/ positive	22.2% (8)	22.7% (5)	47.3%(18)	25% (3)	25% (2)	30% (36)
Slightly positive	39% (14)	27.6% (6)	21% (9)	33.3%(4)	37.5%(3)	30% (36)
Quite positive	22.2% (8)	13.5% (3)	5.5% (4)	33.3%(4)	12.5%(1)	16.7%(20)
Extremely positive	5.5% (2)	0% (0)	4.7% (2)	8.4%(1)	0% (0)	4.2% (5)

TABLE 7

RELIABILITY OF OUTPUT

Question 7: Reliability of output information:

Scale	Division Officer (n-36)	CPO (n-22)	WCS (n-42)	FMS-RT Data Processor (n-12)	Others (n-8)	Overall (n-120)
Extremely high	28% (1)	0% (0)	4.7% (2)	0% (0)	0% (0)	2.5% (3)
Quite high	28% (1)	4.5% (1)	21.4%(16)	16.7%(2)	0% (0)	16.7%(20)
Slightly high	11.1% (4)	22.7% (5)	37.2% (9)	16.7%(2)	50% (4)	20% (24)
Equally high/low	33.3%(12)	36.4% (8)	26.2%(11)	25% (3)	50% (4)	31.6%(38)
Slightly low	11.1% (4)	0% (0)	0% (0)	33.3%(4)	0% (0)	6.6% (8)
Quite low	27.8%(10)	36.4% (8)	7.1% (3)	8.3%(1)	0% (0)	18.3%(22)
Extremely low	11.1% (4)	0% (0)	2.4% (1)	0% (0)	0% (0)	4.3% (5)
Extremely complete	16.7% (6)	18.2% (4)	7.1% (3)	0% (0)	0% (0)	10.8%(13)
Quite complete	8.3% (3)	13.6% (3)	4.7% (2)	33.3%(4)	37.5%(3)	12.6%(15)
Slightly complete	50% (18)	27.5% (6)	21.4% (9)	33.3%(4)	0% (0)	30.8%(37)
Equally complete/ incomplete	16.7% (6)	22.7% (5)	16.6%(18)	33.4%(4)	37.5%(3)	30% (36)
Slightly incomplete	5.5% (2)	9% (2)	4.7% (2)	0% (0)	0% (0)	5% (6)
Quite incomplete	0% (0)	4.5% (1)	43.1% (7)	0% (0)	25% (2)	8.3%(10)
Extremely incomplete	2.8% (1)	4.5% (1)	2.4% (1)	0% (0)	0% (0)	2.5% (3)

TABLE 8

RELEVANCY OF OUTPUT

Question 8: Relevancy of output information to overhaul planning:

Scale	Division Officer (n-36)	CPO (n-22)	WCS (n-42)	FMS-RT Data Processor (n-12)	Others (n-8)	Overall (n-120)
Extremely relevant	0% (0)	0% (0)	2.4% (1)	0% (0)	0% (0)	0.8% (1)
Quite relevant	11.1% (4)	0% (0)	19% (8)	8.3%(1)	12.5%(1)	11.5%(14)
Slightly relevant	19.4% (7)	27.2% (6)	26.3%(11)	41.7%(5)	12.5%(1)	25% (30)
Equally relevant/ irrelevant	58.5%(21)	36.6% (8)	26.2%(11)	41.7%(5)	37.5%(3)	40% (48)
Slightly irrelevant	0% (0)	13.6% (3)	21.4% (9)	0% (0)	12.5%(1)	11% (13)
Quite irrelevant	5.5% (2)	9% (2)	4.7% (2)	8.3%(1)	25% (2)	7.5% (9)
Extremely irrelevant	5.5% (2)	13.6% (3)	0% (0)	0% (0)	0% (0)	4.2% (5)
Extremely useful	0% (0)	0% (0)	4.7% (2)	0% (0)	0% (0)	1.6% (2)
Quite useful	14.1% (5)	9% (2)	19% (8)	16.6%(2)	12.5%(1)	15% (18)
Slightly useful	16.6% (6)	27.4% (6)	23.8%(10)	33.3%(4)	12.5%(1)	22.5%(27)
Equally useful/ useless	50% (18)	27.4% (6)	23.8%(10)	25.2%(3)	37.5%(3)	33.3%(40)
Slightly useless	8.3% (3)	13.6% (3)	23.9%(10)	16.6%(2)	12.5%(1)	15.9%(19)
Quite useless	5.5% (2)	13.6% (3)	2.4% (1)	8.3%(1)	25% (2)	7.5% (9)
Extremely useless	5.5% (2)	9% (2)	2.4% (1)	0% (0)	0% (0)	4.2% (5)

TABLE 9

OUTPUT ACCURACY

Question 9: Accuracy of output information:

Scale	Division Officer (n-36)	CPO (n-22)	WCS (n-42)	FMS-RT Data Processor (n-12)	Others (n-8)	Overall (n-120)
Extremely accurate	11.1% (4)	0% (0)	2.4% (1)	0% (0)	0% (0)	4.3% (5)
Quite accurate	27.8%(10)	36.4% (8)	7.1% (3)	8.3%(1)	0% (0)	18.3%(22)
Slightly accurate	11.1% (4)	0% (0)	0% (0)	33.3%(4)	0% (0)	6.6% (8)
Equally accurate/ inaccurate	33.3%(12)	36.4% (8)	26.2%(11)	25% (3)	50% (4)	31.6%(38)
Slightly inaccurate	11.1% (4)	22.7% (5)	37.2% (9)	16.7%(2)	50% (4)	20% (24)
Quite inaccurate	2.8% (1)	4.5% (1)	21.4%(16)	16.7%(2)	0% (0)	16.7%(20)
Extremely inaccurate	2.8% (1)	0% (0)	4.7% (2)	0% (0)	0% (0)	2.5% (3)
Extremely certain	16.7% (6)	18.2% (4)	7.1% (3	0% (0)	0% (0)	10.8%(13)
Quite certain	8.3% (3)	13.6% (3)	4.7% (2)	33.3%(4)	37.5%(3)	12.6%(15)
Slightly certain	50% (18)	27.5% (6)	21.4% (9)	33.3%(4)	0% (0)	30.8%(37)
Equally certain/ uncertain	16.7% (6)	22.7% (5)	16.6%(18)	33.4%(4)	37.5%(3)	30% (36)
Slightly uncertain	5.5% (2)	9% (2)	4.7% (2)	0% (0)	0% (0)	5% (6)
Quite uncertain	0% (0)	4.5% (1)	43.1% (7)	0% (0)	25% (2)	8.3%(10)
Extremely uncertain	2.8% (1)	4.5% (1)	2.4% (1)	0% (0)	0% (0)	2.5% (3)

We investigated the number of people involved in controlling data entry, or what we call "communicating changes." The users on our survey indicated the following (n=120):

Too many	1.67%	(n=2)
Just right	80%	(n-96)
Too few	18.33%	(n=22)

As you can see, the vast majority of users feel that just enough people are involved in controlling data entry. The number of changes by a work center to the database on a per weekly basis is 8.5 changes per week. The number of changes per week was ascertained by averaging the number of changes indicated by work center supervisors. The total number of changes to the database can be obtained by multiplying the number of work centers by the 8.5 change per work center in a week.

Questions 12 and 13 in our survey are planned enhancements for the FMS-RT system. We surveyed the users to see if these two enhancements are desired. First, would the user like FMS-RT to be interactive? The term "interactive" was explained to the user by making the user aware that the SNAP I and II systems currently on all CRUDES-type ships is an interactive system, interactive meaning that the person changing the data makes the changes himself at the terminal. The users' responses were an overwhelming "yes!" "Yes" responses were 108 to 12 "no" responses.

Second, are the users interested in seeing data from other ships in their class? The users responded as follows:

I [the user] see(s) the need to look at other ships' data	52%	(n=62)
I [the user] see(s) *no* need to look at other ships' data	48%	(n=62)

Questions 14 through 16 were added to verify the researcher's observations. First, the researcher observed that the generated reports seemed only useful to work center supervisors. The higher levels in the chain of command found the report formats vague and not very useful. Table 10 illustrates how each level in the chain of command responded to the question "Are the reports generated in a useful format?"

Second, the researcher observed during training that the reports were presented. However, the training was an explanation of the fields, rather than how to interpret the output and apply the results to the overhaul management process. The survey participants were asked whether they felt their training taught them how to use the output reports as a tool to manage the overhaul process.

Finally, the researcher observed that nearly all users had a manual tracking system in addition to the computer-based FMS-RT system. Table 10 shows how many of each level used a manual tracking system.

The most important perception to get from the user is the overall usability of the FMS-RT system. Table 11 illustrates how the different levels in the chain of command feel about overall usability.

TABLE 10

RESEARCHER OBSERVATION RESULTS

Position	# of Respondents	**Question 14** Are the reports generated in useful format?		**Question 15** Did your training for overhaul on the FMS-RT teach you how to use the output reports as a tool to manage the overhaul process?		**Question 16** Do you use another system in addition to FMS-RT to trace job status like a manual system devised internally?	
		Yes	**No**	**Yes**	**No**	**Yes**	**No**
Commanding Officer (others)	1	0	1	0	1	1	0
Department Head (others)	3	0	3	0	3	2	1
FMS-RT Coordinator (others–3 Dept. Heads (DH)/1 E8)	4	1(E8)	3(DH)	0	4	4	0
Division Officer	36	10	26	8	28	21	15
Chief Petty Officer (E7–E9)	22	4	18	7	15	18	4
Work Center Supervisor	42	28	14	12	30	31	11
FMS-RT Data Processor	12	10	2	4	8	6	6

TABLE 11

OVERALL USABILITY

Overall Usability	Division Officer (n-36)	CPO (n-22)	WCS (n-42)	FMS-RT Data Processor (n-12)	Others (n-8)	Overall (n-120)
Extremely useful	1	0	0	0	0	1
Quite useful	6	4	20	4	3	37
Better than nothing	21	9	12	5	3	50
More of a problem than a useful tool	8	9	10	3	2	32

The last part of our survey asked the user to list any problems or enhancements. Appendix D is a listing of the weaknesses in FMS-RT and possible enhancements provided by the users. The numbers in parentheses after the brief explanation indicate the numbers of respondents with a similar problem or a similar enhancement.

VI. ANALYSIS

A. TRAINING CONTENT

In this section, the researcher will discuss the compatibility between the current training curriculum and the optimal curriculum as defined by the experts. The experts provided a list of topics they found important in an optimal training curriculum. It was found that the topics in the current FMS-RT training program are the same as those in the ideal curriculum with the exception of three subject areas: project management training, advanced project management estimating techniques, and the assignment of responsibilities to implement the program.

1. Project Management

In this section, both project management and advanced estimating techniques will be covered, since both relate to project management. In a question to all the experts, the researcher asked "How important is project management training in a curriculum?" All three experts agreed that project management training is essential to conducting a successful overhaul. Project management is distinguished from production management primarily by the non-repetitive nature of the work; a project is usually a one-time effort. The management of projects is more complicated than the management of a production line due to the following characteristics, generally typical of project management to some degree. The duration of a project can last weeks, months, or even years. During such a long period many changes may occur, most of which are difficult to predict. Such changes may have a significant impact on project costs, technology, and human resource allocation. The longer the duration of the project, the more uncertain are the times and costs. The project can be complex in nature, involving many interrelated activities and participants from both within the organization and outside the organization. Delays in completion time may be very costly. Penalties for delays may amount to thousands of dollars per day. Completing projects late may result in lost opportunities and ill will. Projects are sequential in nature. Some activities cannot start until others are completed. Projects are typically a unique undertaking, something that has not been encountered frequently. Thus, the experts thought that, given the complex nature of overhauls and integration problems created between contractor work and ships force work, project management should be an essential part of the training curriculum. Additionally, given the time constraint of when the overhaul will end, the experts thought that better activity duration estimates would allow better overhaul management. Therefore, the experts felt advanced project management estimating techniques were an equally important part of project management training.

The follow-on question was "At what level in the chain of command should this training be given?" The experts' responses varied from Chief Petty Officers to department heads. One expert felt that it should be taught at the Chief Petty Officer level, but all three agreed that it should be taught at the division officer and department head level. The experts' rationale for including project management training at these levels was that management was basically the job of the division officer. However, the experts clarified this by stating that project management is complex and they felt more experience in ship repair is needed to understand the complex interrelationships of an overhaul. For this reason, the experts felt CPOs and department heads could better understand project management and utilize project management tools during the overhaul.

2. Assignment of Responsibilities

During an overhaul, personnel are given additional management tasks specific to the overhaul in addition to their regular duties. The FMS-RT Administrative Manual explains the responsibilities of certain key overhaul personnel. However, these responsibilities are general in nature. According to the experts, they need to be more clearly defined by the ship's commanding officer. People need to know what they are expected to do during the overhaul, an then they need to know how to accomplish this tasking. The experts feel that this important framework needs to be laid prior to any other training, and that not enough effort is being expended in this regard. The experts also believe that the curriculum must ensure that individual unit planning and training cover the "big picture" items prior to FMS-RT training. The most important thing is to have the overhaul management assignments made and their responsibilities clearly delineated in advance.

In summary, according to the experts, the FMS-RT training curriculum contains the necessary *content* with three exceptions: project management training, advanced estimating techniques, and assignment of responsibilities. The experts recommend that these additional topics be incorporated into the current FMS-RT curriculum.

B. USABILITY

In Table 11, 50 of 120 respondents said that FMS-RT was better than nothing. Only one respondent found it extremely useful. What causes the users to evaluate the FMS-RT system as they have?

The following problems emerged in analyzing survey responses and observing users:

1. CPO Participation

CPOs do not feel that their participation in the overhaul management process is either sufficient or positive. This is evident in Table 5, where about 60 percent of the respondents are in the insufficient and negative ranges of the sales.

2. User Attitude

The attitude of the users is marginally cooperative. Table 6 indicates that for all levels there is only a slightly positive and slightly cooperative attitude toward using FMS-RT. Combining the results found in Table 6, with the 10 respondents in Appendix D who requested an initial SFWP created for the ship, as SFOMS did previously, indicates an FMS-RT system acceptance problem. Some additional responses from the survey participants may explain why acceptance is a critical issue. The following quotes indicate that the FMS-RT system is not as useful as we might like it to be:

> FMS-RT is all right for early in the overhaul, but useless in the latter phases. It does not have enough detailed information on the status of jobs and the pretty graphs tell me very little about the problems or about what caused them. [CDR Loeffler, Ref. 11]

> The reports are not in a useful format and the system is too complex. I own my own personal computer and could build a better and easier to use system in six months. [Survey from a CPO in USS Underwood (FFG-36)]

3. Output

Although the respondents say that the output is reliable and accurate in Tables 7 and 9, the researcher observed that the users find minor inaccuracies because all their changes are not yet entered and reflected in their output reports. Additionally, they are uncertain as to what the reports should tell them. In Appendix D, 17 respondents requested more training on how to use output forms in managing the overhaul. Table 10 indicates that an overwhelming number of respondents feel that the training did not teach them how to use the output forms in managing the overhaul process.

4. Reports

Table 10 indicates that reports are not in a useful format for upper levels in the chain of command. This point was echoed by CDR Loeffler in the quote above and by 15 respondents in Appendix D.

5. Interactive System

108 of 120 respondents want an interactive system. The researcher observed that work center supervisors wanted to make changes to their own data at their (the work center supervisors')

convenience. The work center supervisor want their autonomy when dealing with the FMS-RT system. Currently, the supervisors feel that they have to follow a command-directed schedule for report submission. The researcher believes the data quality would increase if the FMS-RT system were integrated with the SNAP I and II systems. The work center supervisors would then be responsible for updating their part of the data. This solution also would eliminate the users' feeling that output was only relatively reliable and accurate.

6. Training

Appendix D, a summary of the respondents' open-ended comments, shows training is incomplete. However, the researcher in investigating the problem in more detail called the commands that responded with this point for further clarification. The problem was found to be more a transition problem than a training problem. The ships in overhaul prior to January 1988 had SFOMS and had to be converted over to the FMS-RT system. The transition was difficult because the change was abrupt; the training was short, fast-passed, and specific to FMS-RT; and the software had problems that had not been found in testing. Abrupt means that SFOMS was gone on 1 January, and FMS-RT was put in and training held with little notice to the ship. The training highlighted the similarities and differences between the two systems and focused on the differences in the output reports. The software problems created a major problem in getting reports out of the system and created a distrust of the FMS-RT system. The researcher concluded that the crew was overloaded in the transition training. The two-phase training program given currently should prevent the recurrence of this problem.

7. Manual Tracking System

Table 10 indicated that many respondents use a manual tracking system in addition to the FMS-RT system. This indicates that FMS-RT does not provide all the information users want. Appendix D illustrates that respondents want different reports created and more fields added to existing reports for such information as detailed remarks and percentage of job completed.

8. Material Tracking System

The researcher observed that very few commands used the material tracking system in FMS-RT. The system is manual in nature and requires constant updates to be useful. The researcher observed that during overhaul, the Supply Department loses one or two storekeepers to the SOAP team, and receives the most requisitions to handle. Therefore, they have the most work to do with the fewest people to do the work. This is one reason that the additional material tracking provided by FMS-RT is not used. Also, the SNAP system has tracking capability, but SNAP does not generate reports and requires the same constant updating as FMS-RT. Thus, we can understand why, 12 people requested that material tracking be totally automated (see Appendix D).

9. Software Problems

In Appendix D, we see many problems with software that should have been found during acceptance testing. Problems with form feeds, error messages, date printouts on reports, and compartment numbering on reports should have been caught during the testing phases. Other problems, like screen colors and consistency in menu selections, indicate little user involvement in design and lack of concern over usability issues by the developer.

Generally, the FMS-RT system is complex and difficult to use. Stahl's research on usability illustrates that testing for usability can head off disaster [Ref. 15:p. 83]. Stahl indicates that more and more companies are conducting usability tests in addition to testing for bugs. He suggests getting users involved in all phases of software development. Stahl recommends the use of prototyping, videotaping of end-user learning, and objective and subjective testing. Stahl says that it is not enough for software to perform correctly, it must be usable by the end user. The end users *must* be satisfied.

In the case of the FMS-RT system, the data reveal that not all end users are satisfied. The reports are not in a useful format for some levels of the chain of command. The software was sent to the fleet with bugs that should have been found during testing. Task performance time, such as for inputting data, is hampered by poor screen color selection. System learning time is slow due to documentation that is written for a level above the normal user. Also, the documentation is missing things like dip-switch settings for the printer.

In summary, it appears that the FMS-RT was moved from development to fleet implementation too quickly. The software needed better testing and more usability features. The documentation needed to be written for the general user, as mentioned earlier. The reports should have been generated by the users through the use of existing report generators and more reports were needed than are currently provided. The researcher, having seen the system in operation and having reviewed the users' comments, believes that the life expectancy for FMS-RT will be short unless a new system is developed with user involvement in all phases of development. The system should conform to DOD-STD-2167A on Defense System Software Development [Ref. 16] and MIL-STD-1472C Notice 3 on Human Engineering Design Criteria for Military Systems, Equipment, and Facilities [Ref. 17].

VII. RECOMMENDATIONS AND CONCLUSION

The premise of this thesis is that, with a well-developed training curriculum and usable software, we will get increased performance during an overhaul. The researcher concludes that we have a well-developed training curriculum but we have a system that is difficult to use. The FMS-RT system frustrates some end users.

In response to the experts' recommended curriculum changes, the researcher believes that project management training can be conducted in one of three ways. First, it can be incorporated into the curriculum at Surface Warfare Officers School. The training at the existing schools are at the division officer level and the department head level. Therefore, both levels can be taught project management techniques and the curriculum content (advanced or introductory training) can be controlled. Controlling the content can allow the training curriculum to include the advance estimating techniques the experts mentioned, like weighted averages and PERT estimating (a form of weighted average that uses three estimates—an optimistic, a pessimistic, and a normal estimate), until the advanced training is conducted. Second, this training can be incorporated into the FMS-RT training and be given specifically to all three levels (CPOs to department heads) just prior to overhaul. The last way is to teach project management at Surface Warfare School and during FMS-RT training.

Since a great deal of what officers are supposed to do is manage, the placement of project management training would reap the most benefits if it were taught at an introductory level in the Surface Warfare Officer Basic Course, and at a more advanced level in the Surface Warfare Officer Department Head Course. The officers would then be able to better manage overhauls, train subordinates in these techniques, and ideally be better overall managers. A converse argument is to teach project management during FMS-RT training aboard the ship. One could argue that it would be fresh in the manager's mind if it were taught to him just prior to overhaul, and all three levels could participate. The ideal would be to do both— teach project management at Surface Warfare School *and* during FMS-RT training. Further analysis would be needed to cost justify incorporation of any of these components into any curriculum.

However, if we could not teach this topic in both curricula, then the researcher believes that teaching it in Surface Warfare School at both levels is the best approach. The rationale behind this choice is that project management techniques apply to more than just overhauls. The researcher believes that these skills can be used in small availabilities when FMS-RT is not provided. Also, these skills are frequently required by officers in follow-on tours. Project management billets are a large portion of senior officer billets. Also, all three experts agreed that, at a minimum, division officers and department heads need this type of training. For these reasons, the researcher recommends placing project management training in Surface Warfare School.

The training curriculum can be improved by putting more emphasis on how to utilize the output reports as a project management tool. Also, the training curriculum must incorporate project management training for middle-level managers (CPOs to department heads). The training content should include advanced estimating techniques, PERT and CPM techniques, and methods for interpreting computer-generated output.

The software is complex and difficult to use. The end users are not satisfied. The system can be improved by implementing the enhancements requested in Appendix D and also by correcting the problems presented. The enhancements include more forms, additional fields in existing forms, automation of the material tracking function, and the creation of an interactive environment. The problems include form-feed problems, compartment numbering errors, date listing problems on Gantt charts, and error message disappearance before the user can read the message.

In the process of this research, issues for further evaluation came to light. The following is a list of follow-on research that is recommended.

- Conduct a cost-benefit analysis to decide whether to implement the proposed enhancements and corrections of the identified problems as a revision of the software or to develop a new, more usable system.
- Conduct specific research with users to determine the type of reports needed and their formats. This would be extremely

helpful to the future developer of either the enhancements or a new system.

- Evaluate the training methods and the trainer. This research evaluated the training curriculum but not the training methods or the trainer. Evaluation in these areas of training is warranted. The researcher believes better-quality training can be obtained by using videotapes and tutorials. Also, having participated in the current training, the researcher found it dull and uninspiring.
- Investigate the possibility of having a contractor do the total overhaul while the ships force is sent to other ships of the same class for training or to advanced schools. The Canadian Navy overhauls ships this way and is saying it gets a higher-quality overhaul at a lower coast. Also, the crew is better trained because crew members do not forget things about their systems during the long overhaul process. The crew is training while the contractor is working.
- Investigate implementation of an overhaul tracking system on the SNAP I and II systems.
- Investigate methods of automating the material tracking system of FMS-RT. How can we link the ship to the information and status of requisitions in the supply system?

The Navy relies on computer-based systems like FMS-RT to improve its performance. However, the Navy has not provided the software developers access to the end users. This has led to complex systems that are difficult for the user to understand and use. To maintain our advantage strategically and to increase performance operationally, we must develop systems that are not only correct but that can be used. Usability is more than an issue of the 1980s, it is an issue that makes or breaks our systems. It is imperative that we concentrate on identifying those areas where automation will permit personnel to perform to their maximum potential, then develop these systems for the people to use, always considering their knowledge level and capabilities. With these efforts, we can develop specific training programs to obtain maximum performance from both the people and the computer system.

APPENDIX A

LIST OF ABBREVIATIONS

NAVY COMMANDS AND OTHER ORGANIZATIONS

CMSD	Continental Maritime of San Diego (contractor)
NAVSEA	Naval Sea Systems Command
OMB	Office of Management and Budgeting (Executive Office of the President
PERA	Planning and Engineering for Repairs and Alterations
PERA (ASC)	PERA for Amphibious and Support Craft (Norfolk)
PERA (CSS)	PERA for Combat Support Craft (Bremerton)
PERA (CV)	PERA for Aircraft Carriers (San Francisco)
PERA (CRUDES)	PERA for Surface Combatants (Philadelphia)
SEAADSA	Naval Sea Systems Command Automated Data Support Activity
SUPSHIPS	Supervisor of Shipbuilding, Conversion and Repair
TYCOM	Type Commander
COMNAVSURFLANT	Commander Naval Surface Force Atlantic Fleet
COMNAVSURFPAC	Commander Naval Surface Force Pacific Fleet

TYPES OF OVERHAULS/AVAILABILITIES

COH	Complex Overhaul
DPMA	Drydocked Phased Maintenance Availability
DSRA	Drydocked Scheduled Restricted Availability
EDPMA	Extended Drydocked Phased Maintenance Availability
EDSRA	Extended Drydocked Scheduled Restricted Availability
ROH	Regular Overhaul

OTHER ABBREVIATIONS

AWC	Accomplishing Work Center
CPM	Critical Path Method
CSMP	Current Ship's Maintenance Project
FMP	Fleet Modernization Program
FMS-RT	Fleet Management System-Real Time
ILO	Integrated Logistics Overhaul
IMA	Intermediate Maintenance Activity
INFONET	Information Network
INSURV	Board of Inspection and Survey
KEYOPS/KOP/KEY OP	Key Operation
MIS	Management Information System
MOTU	Mobile Training Unit (an IMA)
OVHL	Overhaul
OWC	Originating Work Center
PERT	Program Evaluation Review Technique

POT&I	Pre-Overhaul Test and Inspection
QA	Quality Assurance
SARP	Ship's Alteration and Repair Package
SFOMS	Ship's Force Overhaul Management System
SFWP	Ship's Force Work Package
SIMA	Shore Intermediate Maintenance Activity (an IMA)
SITREP	Situation Report (Commanding Officer's)
SOAP	Supply Overhaul Assistance Program
SS/SC	Scheduled Start/Scheduled Completion (scheduling)
3M	Material, Maintenance, Management

APPENDIX B

FMS-RT INPUT AND OUTPUT FORMS

A. FMS-RT INPUT FORMS

The FMS-RT has been developed with the idea that input forms and paperwork are to be kept to a minimum; therefore, there are relatively few input forms. All forms are graphically produced on the computer screen and can be utilized for all input functions with the exception of the Material Input and OPNAV 4790/2K forms.

1. Forms

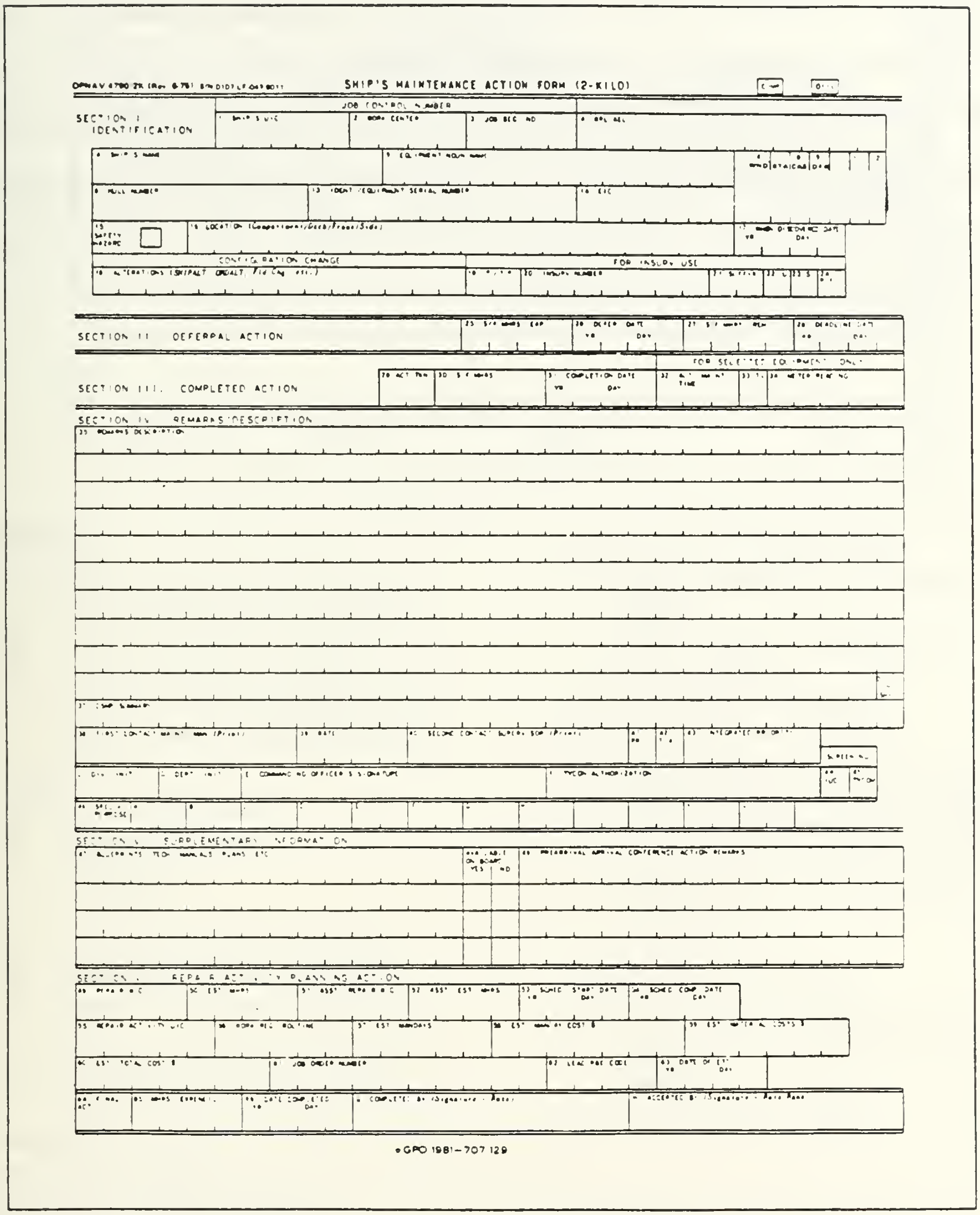
- OPNAV 4790/2K
- FMS-RT Input Form (Optional page 2)
- FMS-RT Key Event Data Form
- FMS-RT Material Request Form
- NAVSUP 1250-1
- DD 1348
- FMS-RT Manpower Planning Form
- FMS-RT Material Status Form

2. OPNAV 4790/2K Form

The OPNAV 4790/2K/2Q/2R Form is the input form for the Ship's 3-M System. Whether a ship is in or out of an industrial availability, a 4790/2K/2Q/2R must be submitted for each job that must be accomplished. Information provided via this form (JCN, noun name, EIC, CSMP summary, etc.) is required in the FMS-RT data file. When the work is accomplished, the 4790/2K is sent to the CSMP to update the ship's maintenance records.

If work cannot be accomplished within 30 days or is to be deferred until an industrial availability period, that work must be entered, via the OPNAV 4790/2K form, into the ship's CSMP. Conceptually, FMS-RT is to interface with the 3-M System (CSMP) to reduce documentation. Therefore, job information (JCN, noun name, EIC, CSMP summary, etc.) contained on either of these forms is used in the FMS-RT data file. The OPNAV 4790/2K/2Q/2R Form is the primary form used to load repair (industrial) work into the FMS-RT data file.

OPNAV 4790/2K
FORM



SHIP'S MAINTENANCE ACTION FORM (2-KILO)

JOB CONTROL NUMBER

SECTION I IDENTIFICATION

16 LOCATION (Compartment/Deck/Frame/Side)

CONFIGURATION CHANGE

FOR INSURV USE

SECTION II DEFERRAL ACTION

FOR SELECTED EQUIPMENT ONLY

SECTION III. COMPLETED ACTION

31 COMPLETION DATE

SECTION IV REMARKS/DESCRIPTION

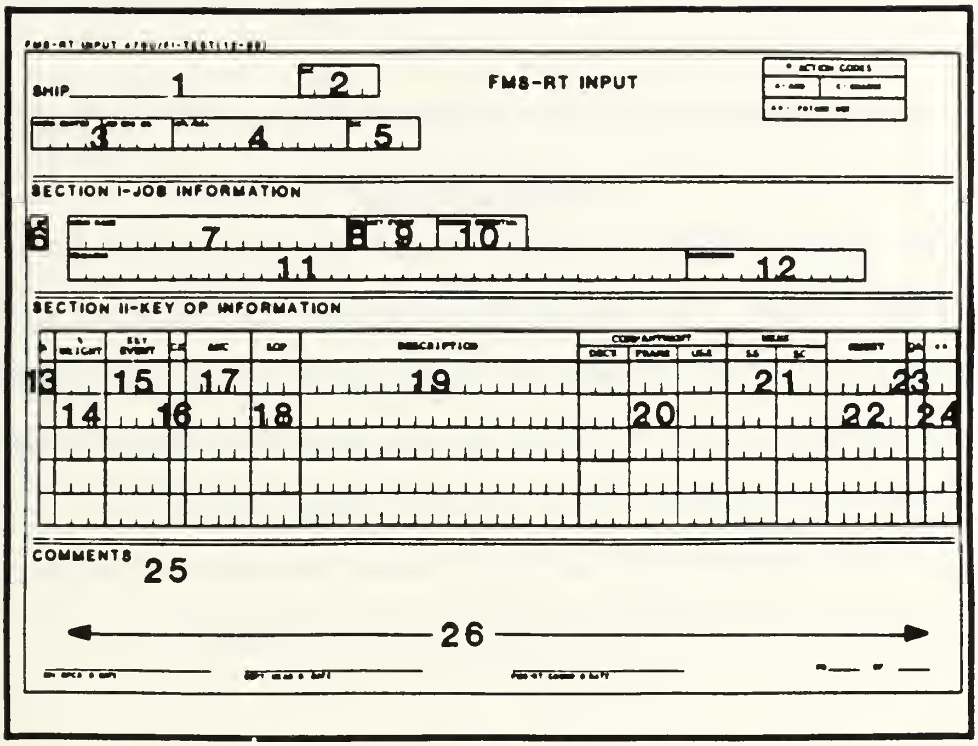
SECTION V SUPPLEMENTARY INFORMATION

SECTION VI REPAIR ACTIVITY PLANNING ACTION

☆GPO 1981—707 129

3. FMS-RT Input Form

A FMS-RT Input Form must be submitted for each job to enter it into FMS-RT. After jobs have been scoped, initial job and KEYOP data are sent to the FMS-RT master file on this form. It can also be used to delete or change existing job data (Section I) and KEYOP data (Section II) and to add additional (new) KEYOPS to existing jobs. Workspace is provided (COMMENTS) for pertinent comments concerning the job or KEYOP.


SHIP
1
2
FMS-RT INPUT
3
4
5
SECTION I-JOB INFORMATION
6
7
8
9
10
11
12
SECTION II-KEY OP INFORMATION
13
14
15
16
17
18
19
20
21
22
23
24
COMMENTS
25
26

LEGEND

1. Ship's Name and Hull Number
2. Unit Identification Code (UIC)
3. Job Control Number (JCN)
4. Allowable Parts Lists/Allowable Equipage List (APL), (AEL)
5. Equipment Identification Code (EIC)

SECTION I—JOB INFO

6. Action Code Noun
7. Job Name
8. Priority
9. Job Level Key Event Number
10. Mission Essential Number
11. Remarks that will amplify the job
12. Screening Action by TYCOM (assignments of responsibilities)

SECTION II—KEYOP INFO

13. Action Code
14. Percentage of Total Job
15. KEYOP Level Key Event
16. KEYOP "Critical" Flag*
17. Accomplishing Work Center (AWC)
18. KEYOP Number Assigned to Each Entry
19. Description of KEYOP
20. Compartment Number
21. Scheduled Start Week (SS) and Scheduled Completion Week (SC)
22. Man-Hours Estimated (in whole hours) to Accomplish the KEYOP
23. Quality Control Requirement (optional)
24. For Future Use

COMMENTS SECTION

25. Worksheet for Pertinent Comments Concerning the Job or a KEYOP
26. Continuation Sheet

---

* If KEYOP completion is critical to its associated Key Event, place a pound sign (#) here.

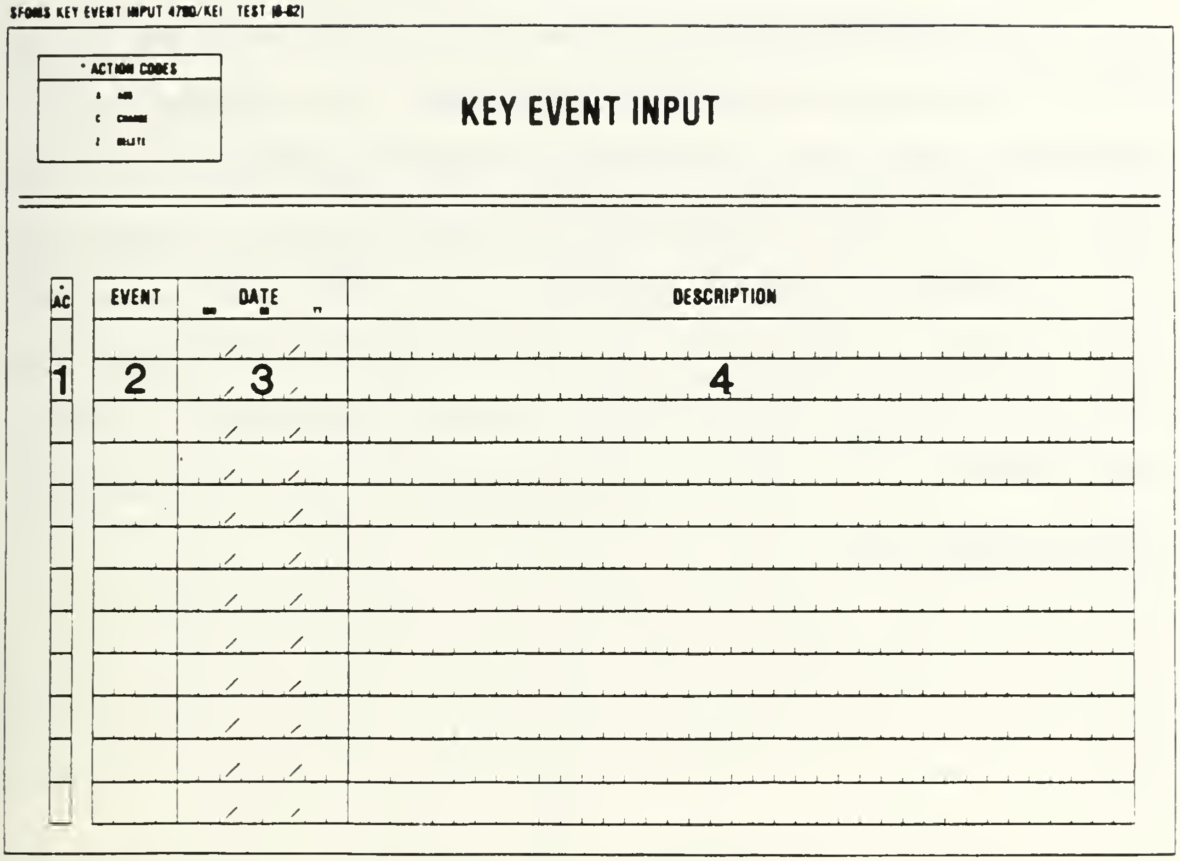
4. FMS-RT Key Event Input Form

An FMS-RT Key Event Input Form is used to enter or to change pertinent data concerning shipyard Key Events. This data associates specific dates to Key Events and produces "flags" when these dates change. This feature aids Shipyard Coordinators in locating jobs and KEYOPS that are affected by shipyard schedules and schedule changes. Key Event data provided by this form is optional except when a Key Event is associated with a critically flagged KEYOP.*

In this case, Key Event data must have been entered prior to, or be entered concurrent with, the "critical" designation.

---

* The "critical" flag provides a method to improve interface between ship's force work and shipyard work by identifying those ship's force work Key Operations (KEYOP) which directly affect shipyard Key Events.



SFOMS KEY EVENT INPUT 4790/KEI TEST (8-82)

* ACTION CODES
A ADD
C CHANGE
D DELETE

KEY EVENT INPUT

* AC	EVENT	DATE MM DD YY	DESCRIPTION
		/ /	
		/ /	
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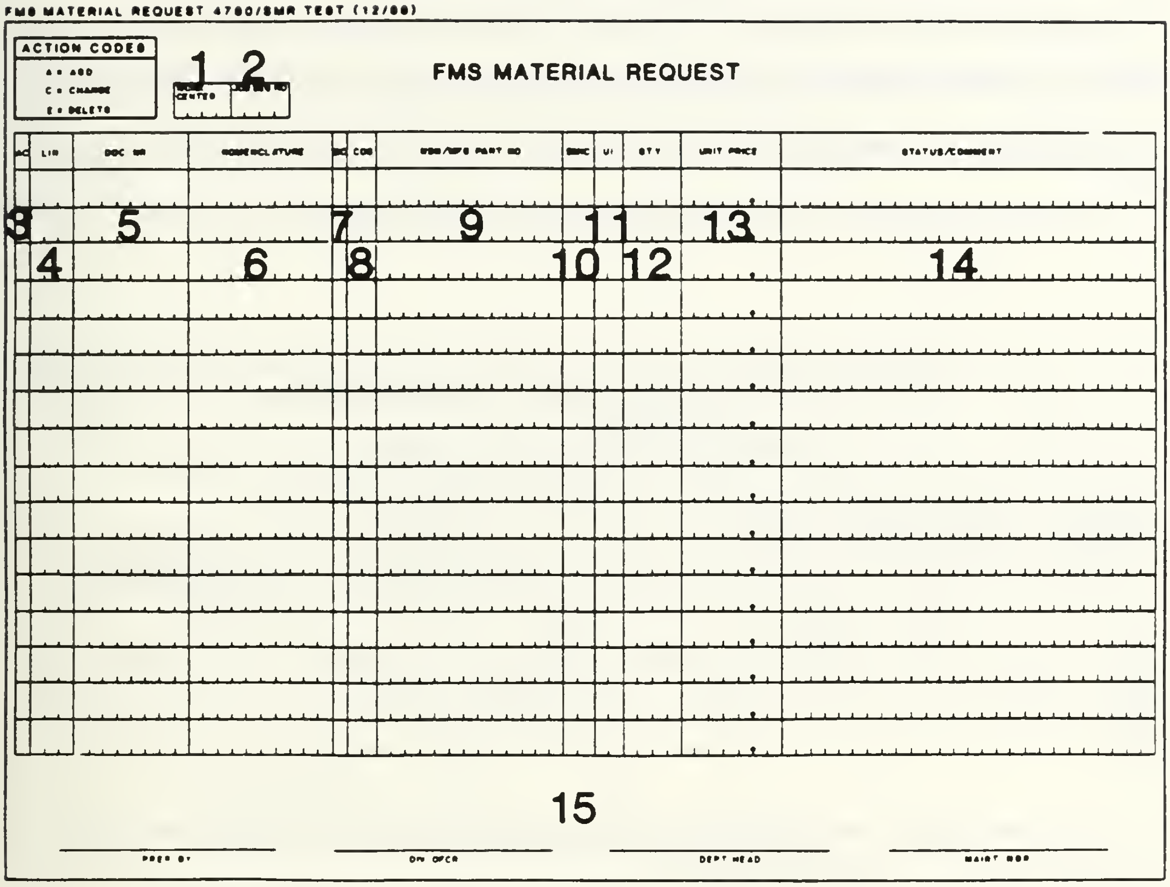
		/ /	
		/ /	

LEGEND

1. Action Code
2. Key Event
3. Key Event Date
4. Key Event Description

5. FMS-RT Material Request Form

An FMS-RT Material Request Form must be submitted for every job requiring material. The form is used to list material required for each job and to enter the information into the FMS-RT master file. When the related job is approved for accomplishment by ship's force, the material may be ordered. The form is also used to change or delete data that have already been entered into the FMS-RT master file. NOTE; When policy allows FMS-RT Material Requests to be made using NAVSUP 1250-1 or DD1348, these forms may be substituted (see following pages).



FMS MATERIAL REQUEST 4790/SMR TEST (12/88)

ACTION CODES
A = ADD
C = CHANGE
D = DELETE

WORK CENTER | JOB SEQ NO

FMS MATERIAL REQUEST

AC	LIN	DOC NR	NOMENCLATURE	SC	COG	NSN/MFG PART NO	SMIC	UI	QTY	UNIT PRICE	STATUS/COMMENT

PREP BY
DIV OFCR
DEPT HEAD
MAINT MGR

1
2
3
5
7
9
11
13
4
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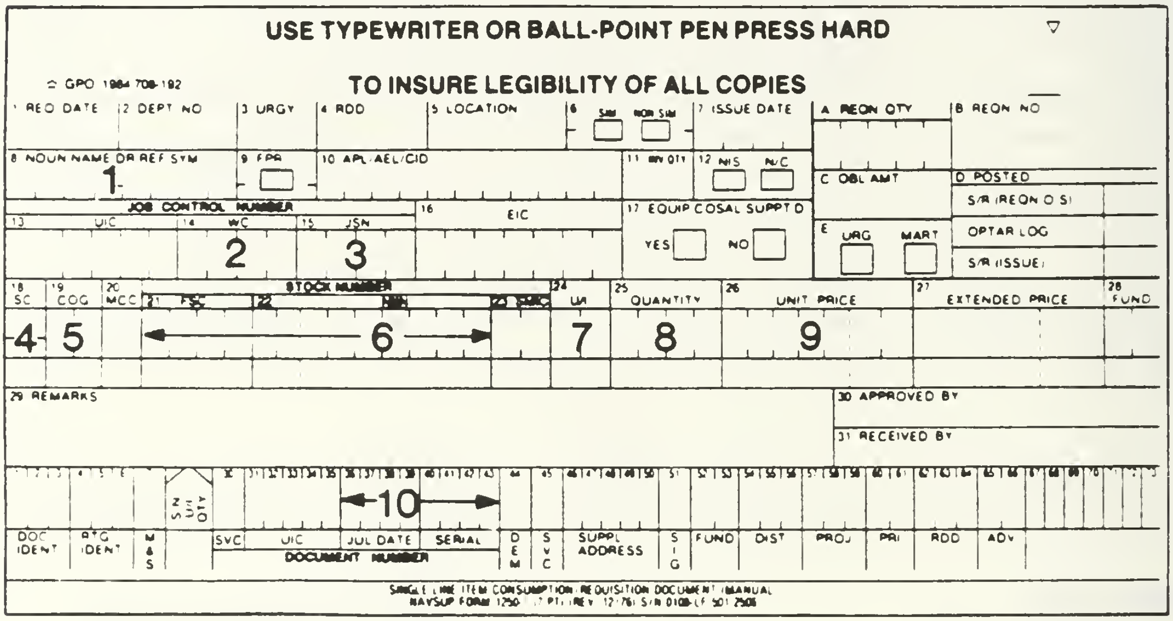
12
14
15

LEGEND

1. Work Center
2. Job Sequence Number (JSN)
3. Action Code
4. Line Item Number (blank unless making a change)
5. Documentation Number
6. Common Name of Material
7. Signal Code (used by Supply Department)
8. COG (first two characters of national stock number)
9. NSN, or manufacturer's part number
10. Special Material Identification Code
11. Unit of Issue
12. Quantity
13. Unit Price
14. Pertinent Comments on the Status
15. Signatures

6. NAVSUP Form 1250-1 Material Requisition Document

A legible copy of a NAVSUP Form 1250-1 may be used to identify material required for each job and may be used to enter the information into the FMS-RT master file. Elements required to generate a FMS-RT material listing are listed in the legend.



USE TYPEWRITER OR BALL-POINT PEN PRESS HARD

TO INSURE LEGIBILITY OF ALL COPIES

GPO 1984 708-192

1 REQ DATE
2 DEPT NO
3 URGY
4 RDD
5 LOCATION
6 SIM ☐ NON SIM ☐
7 ISSUE DATE
A REQN QTY
B REQN NO
8 NOUN NAME OR REF SYM
9 FPA ☐
10 APL/AEL/CID
11 INV QTY
12 NIS ☐ N/C ☐
C OBL AMT
D POSTED
S/R (REQN O S)
OPTAR LOG
S/R (ISSUE)
JOB CONTROL NUMBER
13 UIC
14 WC
15 JSN
16 EIC
17 EQUIP COSAL SUPPT D YES ☐ NO ☐
E URG ☐ MART ☐
STOCK NUMBER
18 SC
19 COG
20 MCC
21 FSC
22 NIIN
23 SMIC
24 UI
25 QUANTITY
26 UNIT PRICE
27 EXTENDED PRICE
28 FUND
29 REMARKS
30 APPROVED BY
31 RECEIVED BY
DOC IDENT
RTG IDENT
M & S
UNIT QTY
DOCUMENT NUMBER
SVC
UIC
JUL DATE
SERIAL
DEM
SVC
SUPPL ADDRESS
SIG
FUND
DIST
PROJ
PRI
RDD
ADV

SINGLE LINE ITEM CONSUMPTION/REQUISITION DOCUMENT (MANUAL)
NAVSUP FORM 1250-1 (7 PT) (REV 12/76) S/N 0108-LF-501-2505

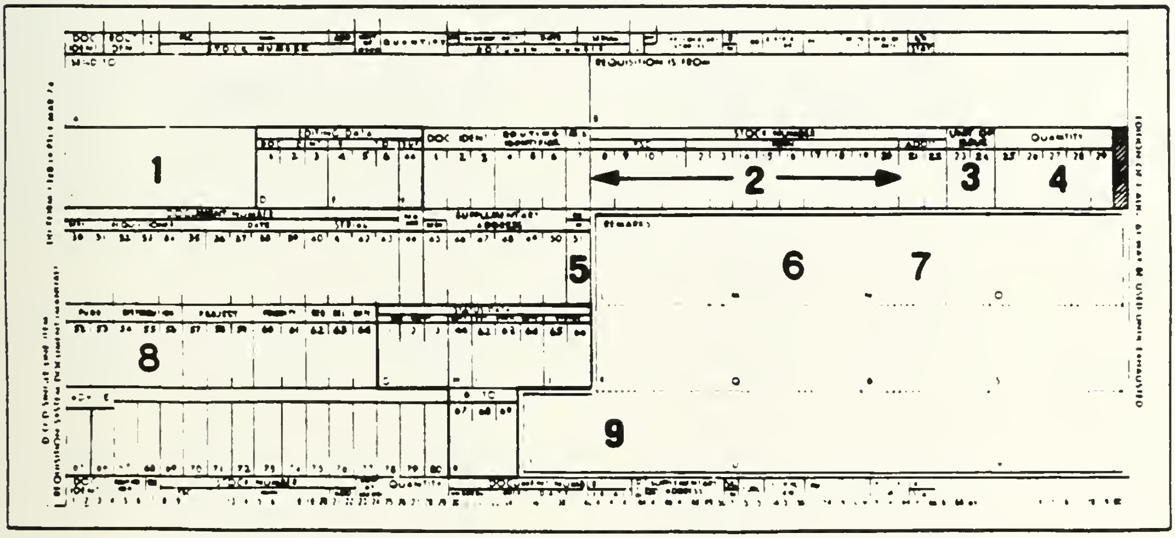
LEGEND

1. (Block 8) Noun Name
2. (Block 14) Work Center
3. (Block 15) Job Sequence Number
4. (Block 18) Signal Code
5. (Block 19) COG
6. (Blocks 21–22) Stack Number
7. (Block 24) Unit of Issue
8. (Block 25) Quantity
9. (Block 26) Unit Price
10. (Blocks 36–43) Julian Date

NOTE: In addition, work centers will continue to complete all elements of DD NAVSUP Form 1250-1 required by the individual ship's Supply Department.

7. DD1348 Material Request Form

A legible copy of a DD Form 1348 may be used to identify material required for each job and may be used to enter the information into the FMS-RT master file. Elements required to generate a FMS-RT material listing are shown in the legend.



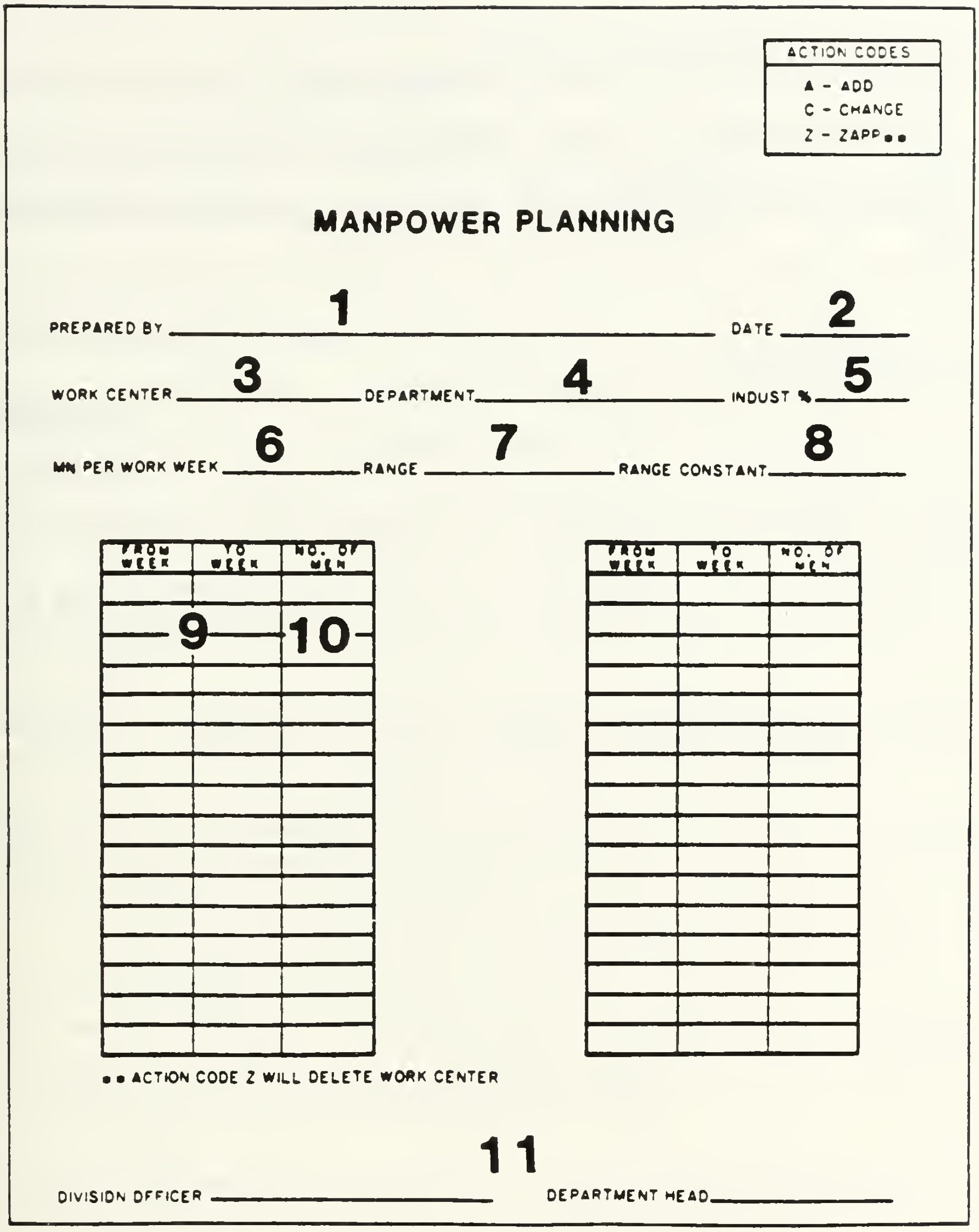
LEGEND

1. (Block C) Noun Name
2. (Columns 8-20) Stock Number
3. (Columns 23-24) Unit of Issue
4. (Columns 25-29) Quantity
5. (Column 51) Signal Code
6. (Block M) Work Center
7. (Block N) Job Sequence Number
8. (Columns 55-56) COG
9. (Block T) Unit Price

NOTE: In addition, work centers will continue to complete all elements of DD Form 1348 as required by the individual ship's Supply Department.

8. FMS-RT Manpower Planning Form

This form provides information on the expected level of manpower for each work center for every week of the availability. Any changes to the original estimates are also made using this form.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11

ACTION CODES
A - ADD
C - CHANGE
Z - ZAPP••

MANPOWER PLANNING

PREPARED BY ____________ DATE ______
WORK CENTER ______ DEPARTMENT ______ INDUST % ______
MN PER WORK WEEK ______ RANGE ______ RANGE CONSTANT ______

FROM WEEK	TO WEEK	NO. OF MEN

FROM WEEK	TO WEEK	NO. OF MEN

•• ACTION CODE Z WILL DELETE WORK CENTER

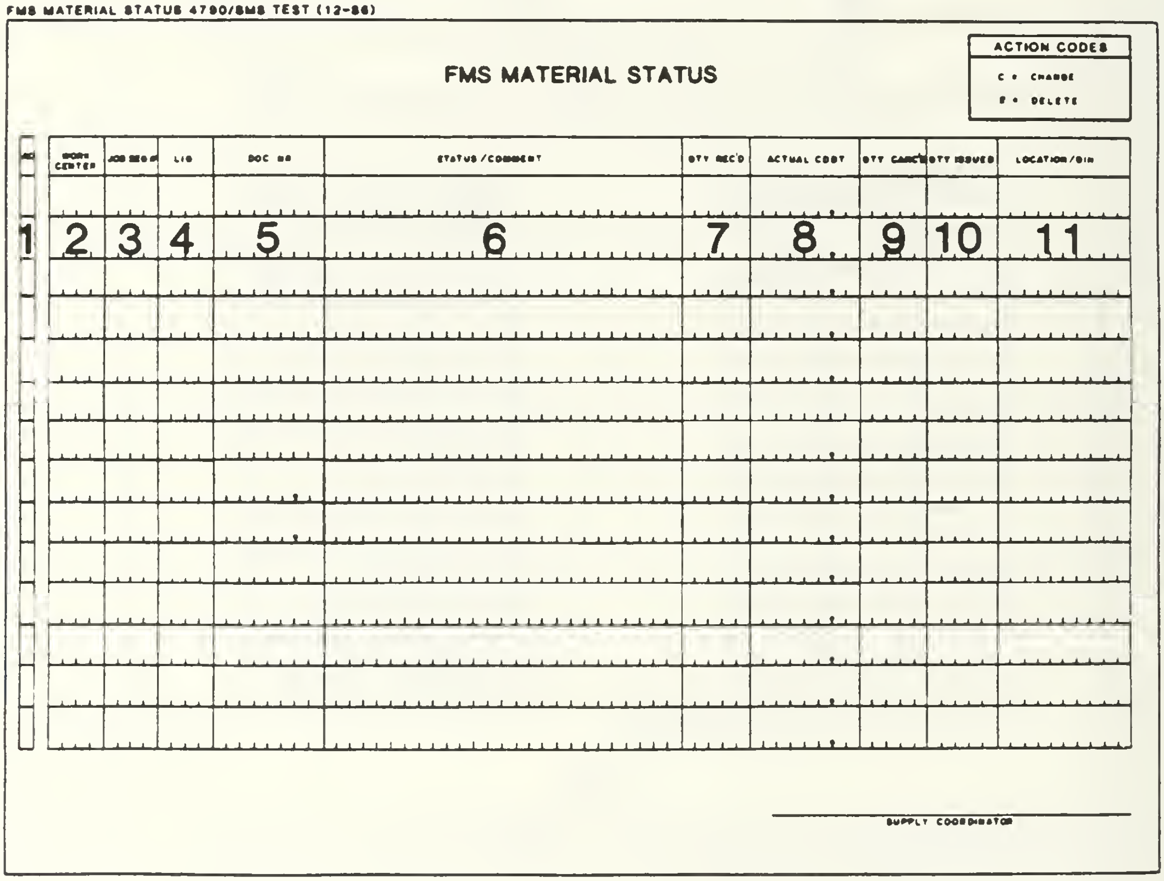
DIVISION OFFICER ______________ DEPARTMENT HEAD ______________

LEGEND

1. Name of Originator
2. Date Prepared
3. Work Center Code
4. Department
5. Percentage of Industrial Availability
6. Number of Men per Work Week
7. Range of Weeks for Men per Week
8. Range Constant of Men per Week for designated weeks
9. Envelope of Time (from week to week)
10. Number of Men Available in those weeks
11. Signatures

9. FMS-RT Material Status Form

This form is for the use of the Supply Coordinator only. It is used to put current information on material status into the FMS-RT master file.



FMS MATERIAL STATUS 4790/SMS TEST (12-86)

FMS MATERIAL STATUS

ACTION CODES

C = CHANGE

D = DELETE

AC	WORK CENTER	JOB SEQ #	LI#	DOC NR	STATUS/COMMENT	QTY REC'D	ACTUAL COST	QTY CANC'D	QTY ISSUED	LOCATION/BIN
1	2	3	4	5	6	7	8	9	10	11

SUPPLY COORDINATOR

LEGEND

1. Action Code
2. Work Center Code
3. Job Sequence Number
4. Line Item Number
5. Document Number
6. Pertinent Comments on the Status
7. Quantity Received
8. Actual Cost of Material Received
9. Quantity Cancelled
10. Quantity Issued
11. Storage/Location/Bin

B. FMS-RT OUTPUT REPORTS

The FMS-RT, being a real-time system, has been developed with the idea that the basic reports are to be generated and excerpts from those reports will be available for the Availability Managers on an as-needed and demand basis. These reports may be modified or drawn on a selectability basis from the Mission Essential work at a work center level to that of a total work package for the entire ship. The only limitations are those of the needs of the Availability Managers. The basic reports are as follows.

1. Reports

- **Session Register**. A report that indicates all the entries and actions taking place in the last update to the database.
- **Work List w/Material**. A report that indicates all of the work, Keyops, and material specified for a single work center, a range of work centers, or the entire ship.
- **Work List w/o Material**. Same report as with material.
- **Material Management Report**. This report is a material report that can be drawn by document number and/or by NSN stock number. This also shows stowage location.
- **Scheduling GANTT Report**. This report is used by the ship's work center supervisors and/or the personnel selected to accomplish the scheduling of the ship's force work package.
- **Key Event List**. This is a listing of the Key Events that will be used by the overhauling activity to schedule its work package and provided by the activity's Scheduling Department.
- **Workload Forecast and Summary**. This is a report that indicates to the Division Officer or the Availability Manager the capability of a work center for all or part of an availability. This report will indicate those capabilities in both man-hours and man-days.

- **Department Projection**. This is a line graph projection of the selected department's capabilities (manpower) and workload (schedule work) for a 15-week window, selectable.

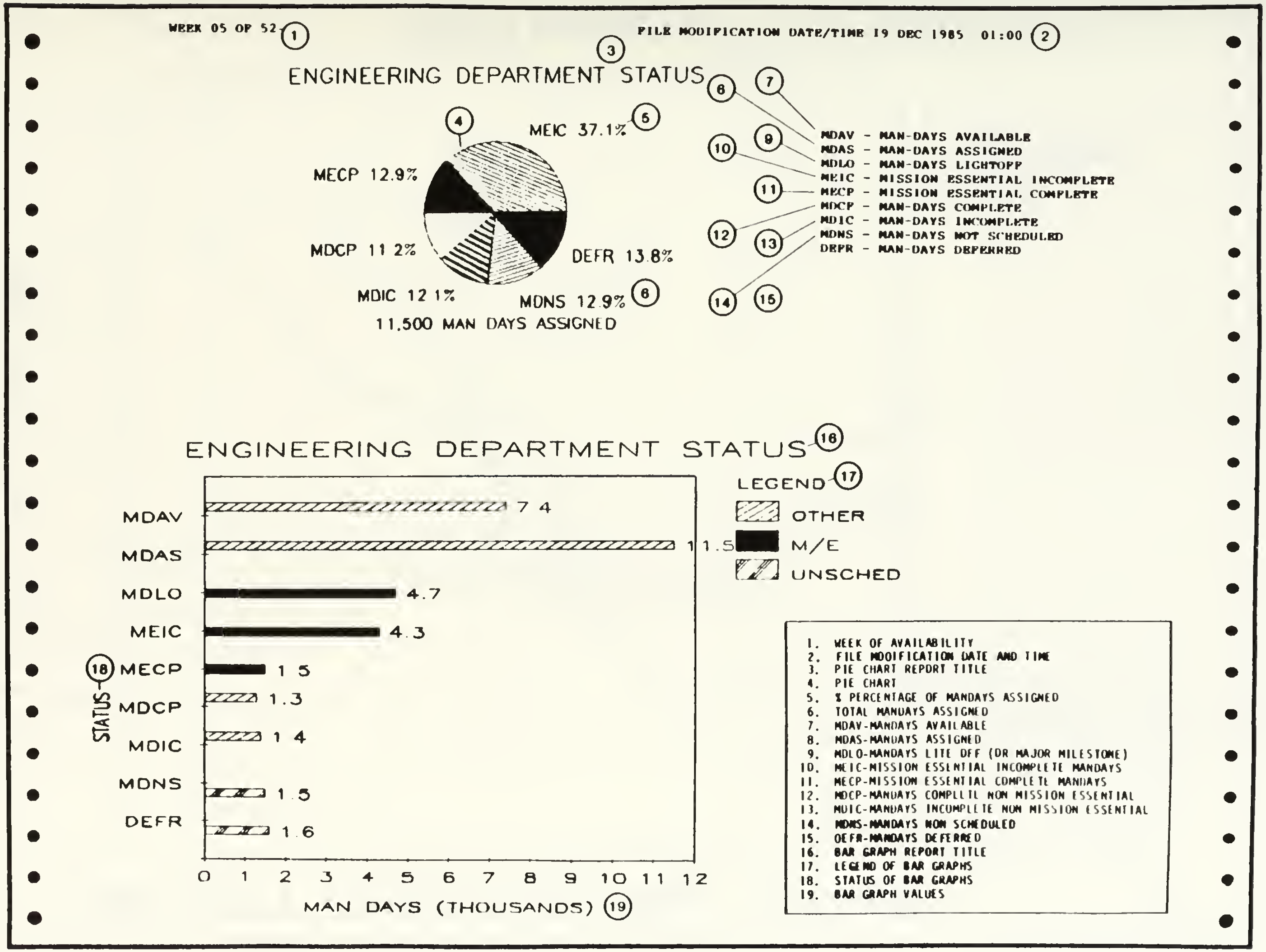
- **Accomplishing Work Center Report**. This is the report that the work center will use as an input form to indicate accomplishment of jobs and/or Keyops, 4-week window.

- **Department Status**. This is a bar graph/pie chart that indicates at the department level the capabilities, liabilities, and accomplishments of the selected department.

- **Commanding Officer's Status**. This report is a ship-level report that indicates at the ship level the liabilities, assets, and accomplishments of the ship's force.

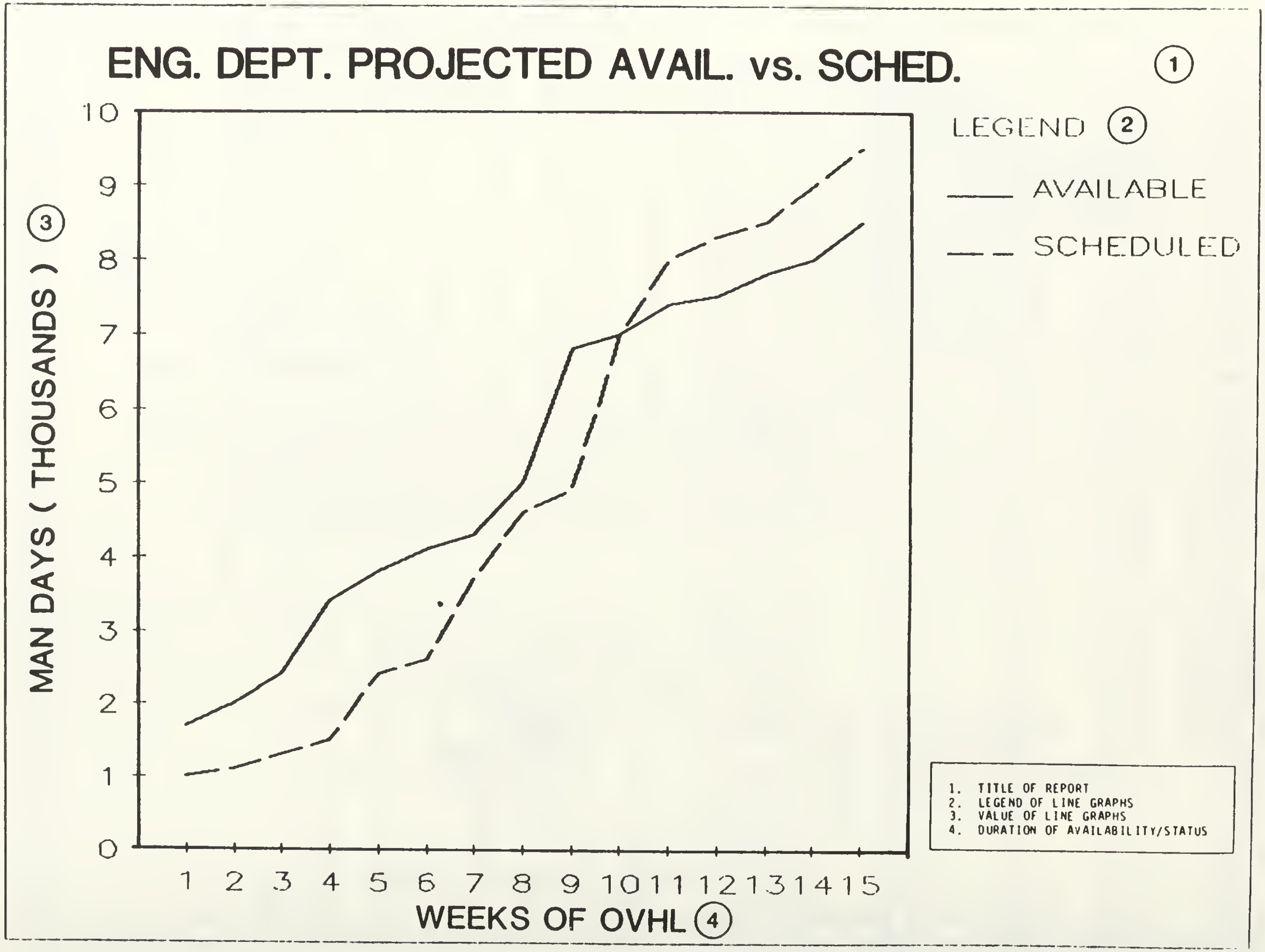
- **Ship's Status**. This is a status report only and cannot be updated as an individual report. It is meant for a quick output for the ship's Commanding Officer and/or the Availability Manager. This report is updated continually as the database is changed in any way and could be considered the most current data available.

The above-listed reports are those that are available from the system on an as-is basis. If there are unique requirements that the managers need for command reports and/or quick looks, the above reports may be selectively printed. There is also being considered, for the future, a selectable report writer that will allow the individual manager to design a report as his individual needs dictate. This will be in level II of the FMS-RT and input from the user will be required. If there are immediate needs for unique reports, contact your PERA Representative or the FMS-RT Program Manager.



MDAV - MAN-DAYS AVAILABLE
MDAS - MAN-DAYS ASSIGNED
MDLO - MAN-DAYS LIGHTOFF
MEIC - MISSION ESSENTIAL INCOMPLETE
MECP - MISSION ESSENTIAL COMPLETE
MDCP - MAN-DAYS COMPLETE
MDIC - MAN-DAYS INCOMPLETE
MDNS - MAN-DAYS NOT SCHEDULED
DEFR - MAN-DAYS DEFERRED

1. WEEK OF AVAILABILITY
2. FILE MODIFICATION DATE AND TIME
3. PIE CHART REPORT TITLE
4. PIE CHART
5. % PERCENTAGE OF MANDAYS ASSIGNED
6. TOTAL MANDAYS ASSIGNED
7. MDAV-MANDAYS AVAILABLE
8. MDAS-MANDAYS ASSIGNED
9. MDLO-MANDAYS LITE OFF (OR MAJOR MILESTONE)
10. MEIC-MISSION ESSENTIAL INCOMPLETE MANDAYS
11. MECP-MISSION ESSENTIAL COMPLETE MANDAYS
12. MDCP-MANDAYS COMPLETE NON MISSION ESSENTIAL
13. MDIC-MANDAYS INCOMPLETE NON MISSION ESSENTIAL
14. MDNS-MANDAYS NON SCHEDULED
15. DEFR-MANDAYS DEFERRED
16. BAR GRAPH REPORT TITLE
17. LEGEND OF BAR GRAPHS
18. STATUS OF BAR GRAPHS
19. BAR GRAPH VALUES


ENG. DEPT. PROJECTED AVAIL. vs. SCHED. ①
LEGEND ②
AVAILABLE
SCHEDULED
MAN DAYS (THOUSANDS) ③
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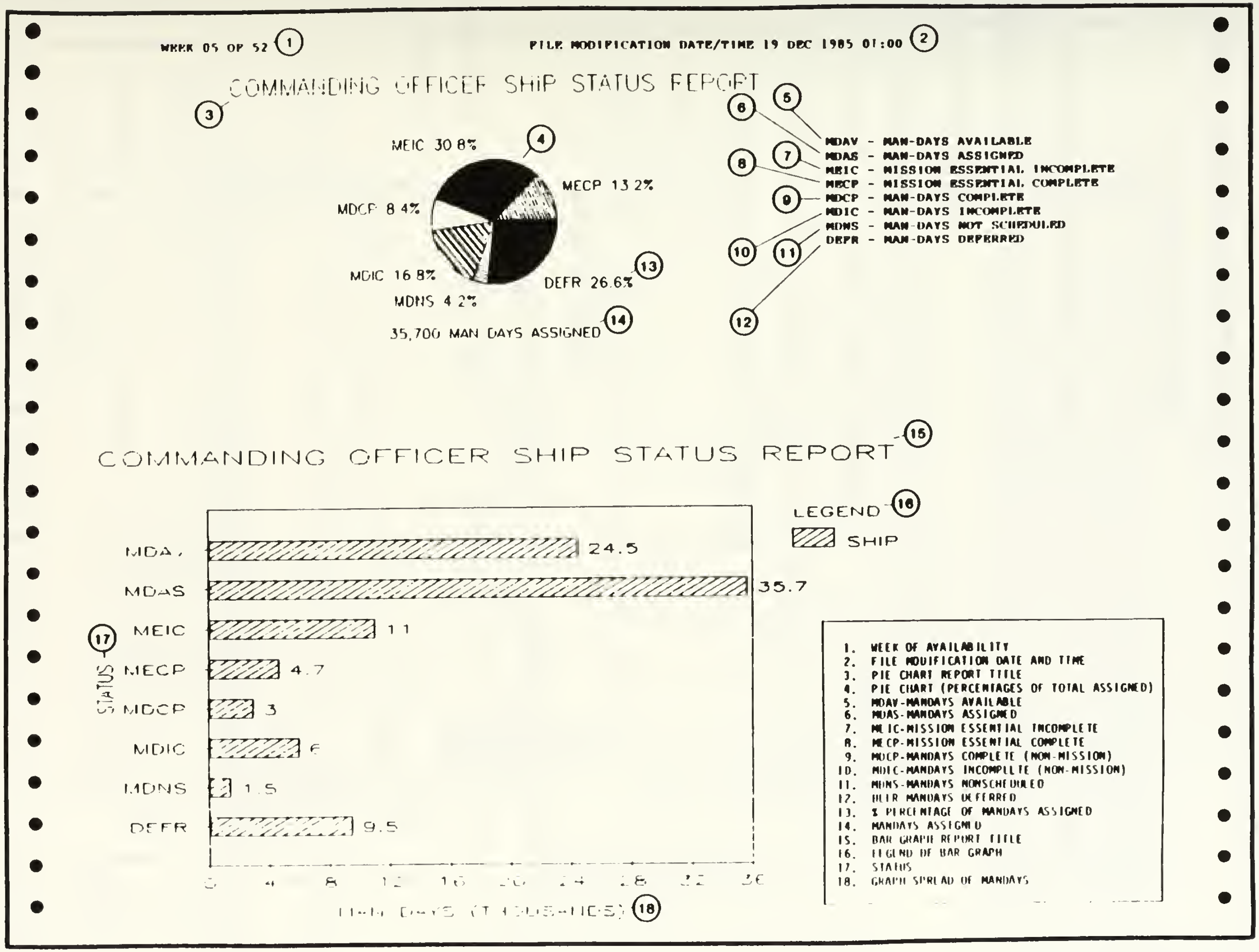
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
WEEKS OF OVHL ④
1. TITLE OF REPORT
2. LEGEND OF LINE GRAPHS
3. VALUE OF LINE GRAPHS
4. DURATION OF AVAILABILITY/STATUS



WEEK 05 OF 52 ①

FILE MODIFICATION DATE/TIME 19 DEC 1985 01:00 ②

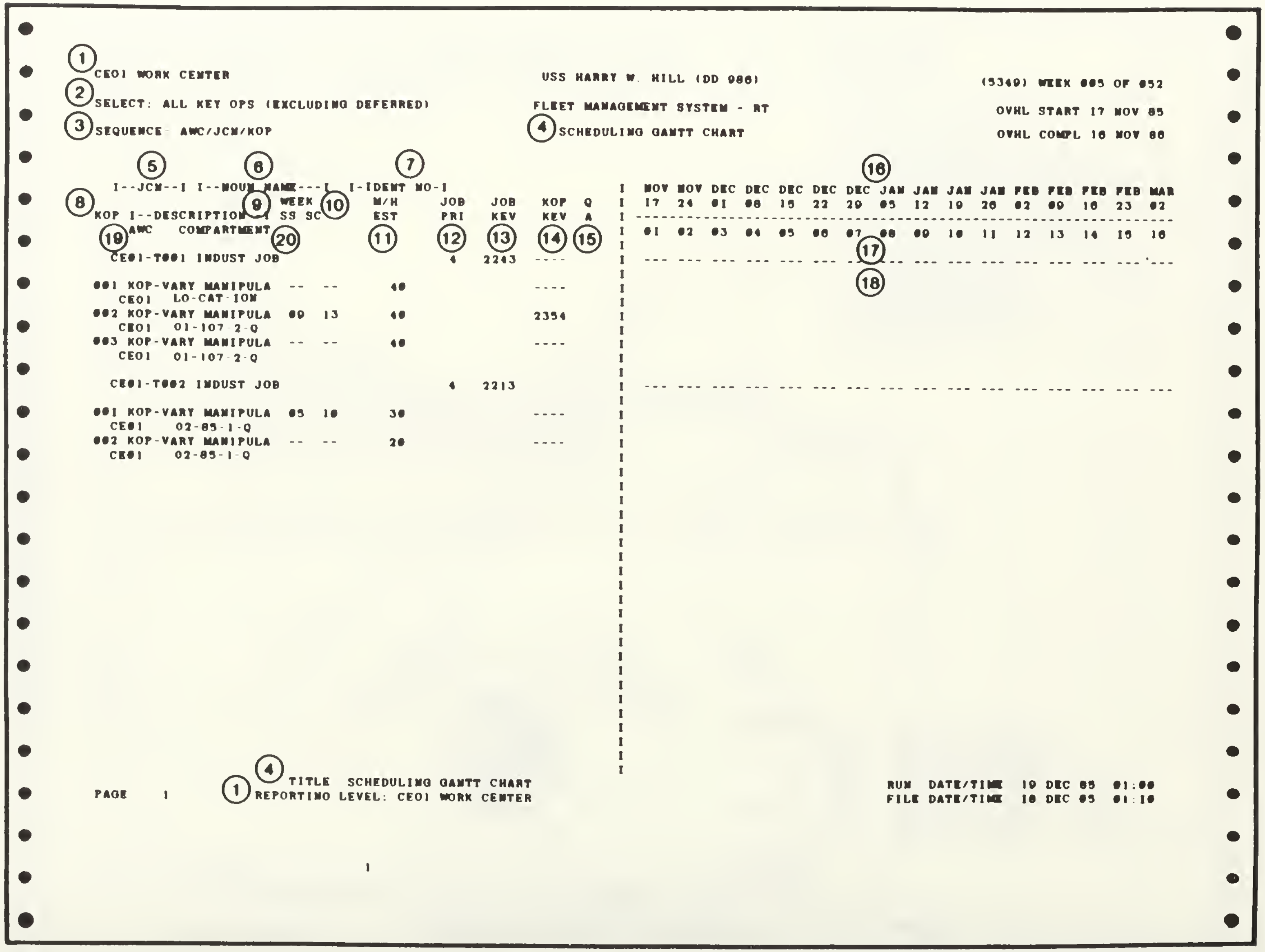
COMMANDING OFFICER SHIP STATUS REPORT ③

35,700 MAN DAYS ASSIGNED ⑭

⑤ MDAV - MAN-DAYS AVAILABLE
⑥ MDAS - MAN-DAYS ASSIGNED
⑦ MEIC - MISSION ESSENTIAL INCOMPLETE
⑧ MECP - MISSION ESSENTIAL COMPLETE
⑨ MDCP - MAN-DAYS COMPLETE
⑩ MDIC - MAN-DAYS INCOMPLETE
⑪ MDNS - MAN-DAYS NOT SCHEDULED
⑫ DEFR - MAN-DAYS DEFERRED

COMMANDING OFFICER SHIP STATUS REPORT ⑮

1. WEEK OF AVAILABILITY
2. FILE MODIFICATION DATE AND TIME
3. PIE CHART REPORT TITLE
4. PIE CHART (PERCENTAGES OF TOTAL ASSIGNED)
5. MDAV-MANDAYS AVAILABLE
6. MDAS-MANDAYS ASSIGNED
7. MEIC-MISSION ESSENTIAL INCOMPLETE
8. MECP-MISSION ESSENTIAL COMPLETE
9. MDCP-MANDAYS COMPLETE (NON-MISSION)
10. MDIC-MANDAYS INCOMPLETE (NON-MISSION)
11. MDNS-MANDAYS NONSCHEDULED
12. DEFR MANDAYS DEFERRED
13. % PERCENTAGE OF MANDAYS ASSIGNED
14. MANDAYS ASSIGNED
15. BAR GRAPH REPORT TITLE
16. LEGEND OF BAR GRAPH
17. STATUS
18. GRAPH SPREAD OF MANDAYS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```
CE01 WORK CENTER                                   USS HARRY W. HILL (DD 986)                      (5349) WEEK 005 OF 052
SELECT: ALL KEY OPS (EXCLUDING DEFERRED)           FLEET MANAGEMENT SYSTEM - RT                     OVHL START 17 NOV 85
SEQUENCE  AWC/JCN/KOP                              SCHEDULING GANTT CHART                           OVHL COMPL 16 NOV 86

   I--JCN--I I--NOUN NAME---I  I-IDENT NO-I        I NOV NOV DEC DEC DEC DEC DEC JAN JAN JAN JAN FEB FEB FEB FEB MAR
                   WEEK        M/H    JOB   JOB   KOP  Q  I 17  24  01  08  15  22  29  05  12  19  26  02  09  16  23  02
KOP I--DESCRIPTION--I SS SC    EST    PRI   KEV   KEV  A  I ----------------------------------------------------------------
   AWC    COMPARTMENT                                      I 01  02  03  04  05  06  07  08  09  10  11  12  13  14  15  16
  CE01-T001 INDUST JOB                  4   2243  ----     I --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---
                                                           I
001 KOP-VARY MANIPULA  --  --   40                ----     I
   CE01  LO-CAT-ION                                        I
002 KOP-VARY MANIPULA  09  13   40                2354     I
   CE01  01-107-2-Q                                        I
003 KOP-VARY MANIPULA  --  --   40                ----     I
   CE01  01-107-2-Q                                        I
                                                           I
  CE01-T002 INDUST JOB                  4   2213           I --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---
                                                           I
001 KOP-VARY MANIPULA  05  10   30                ----     I
  CE01    02-85-1-Q                                        I
002 KOP-VARY MANIPULA  --  --   20                ----     I
  CE01    02-85-1-Q                                        I

PAGE    1         TITLE  SCHEDULING GANTT CHART                                  RUN  DATE/TIME  19 DEC 85  01:00
                  REPORTING LEVEL: CE01 WORK CENTER                              FILE DATE/TIME  18 DEC 85  01:10
```

2. Scheduling GANTT Chart

a. Report Narrative

The purpose of this report is to provide a planning tool used by the work center supervisor to initially schedule work over the length of the availability. In addition, the report provides information for the following:

- Ship's overhaul scheduled start and completion dates
- Key operation man-hours estimated
- Key operation scheduled start and completion weeks (if available)
- Key operation key event (if available)
- Job key event
- Job priority

b. Report Design

The report is produced in accomplishing work center sequence. The report displays all weeks covering the length of the overhaul.

Further report specifications are as follows:

- Headers and trailers are standard (except report title and selection data)
- If schedule start and completion weeks are available for a key operation, they will be displayed on the report; otherwise, dashes will appear.
- Computed items are as follows:
  - Man-hours remaining
  - Man-hours used

c. *Report Selection*

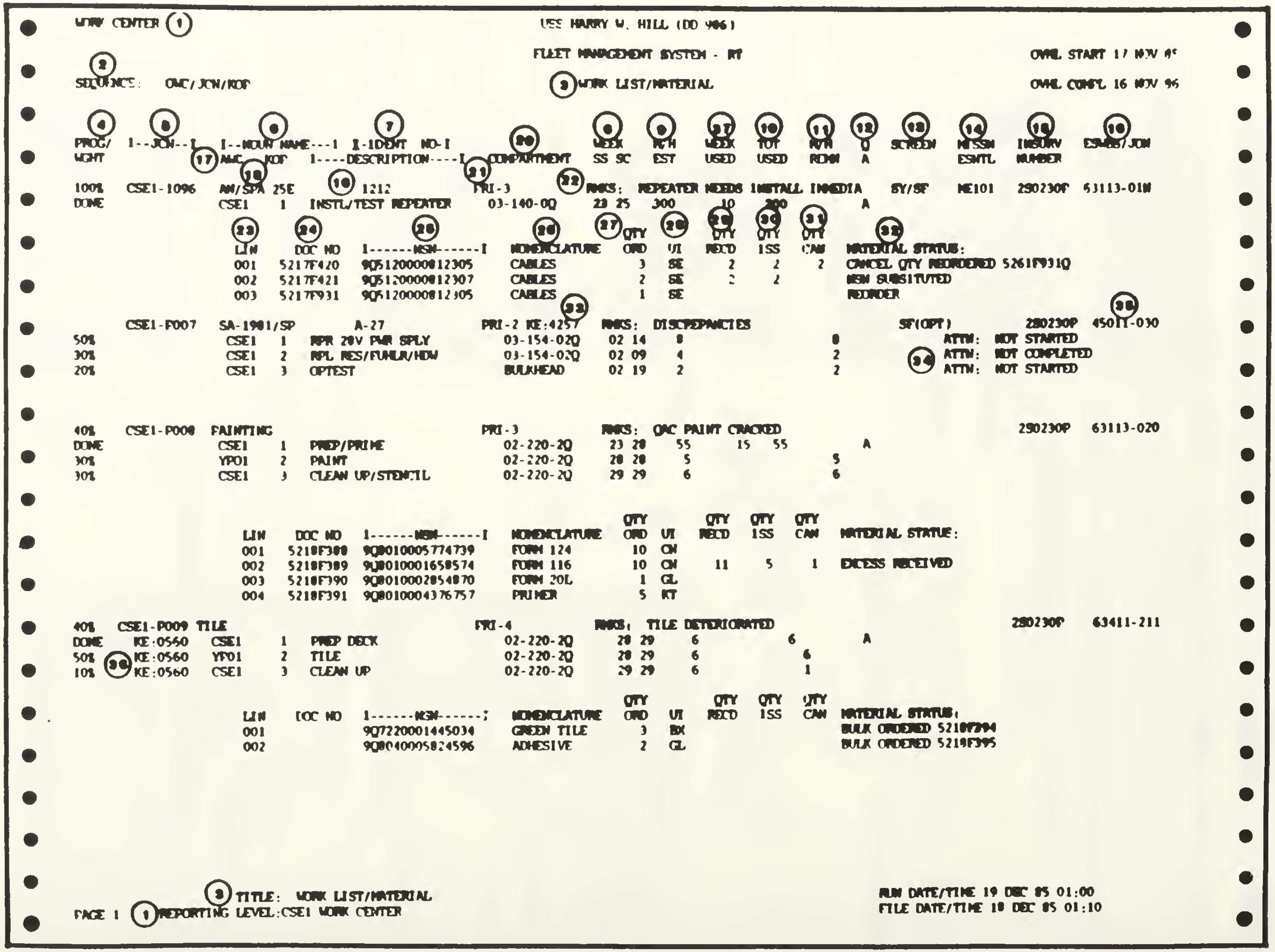
The user may select a single work center, a string of work centers, a range of work centers, or any combination of work centers. With the exception of deferred jobs and finished key-ops or jobs, the report will display all other jobs and key-ops.

d. *Field Descriptions*

With the exceptions noted below, descriptions of the report headers and trailers are in the specifications for standard report headers and trailers.

Item Number	Column Heading	Input Mnemonic	Description of Data
1	STD-HDR1-WC STD-TRL2-REPORT LEVEL	WC-WC	Work center designators Work center code is from the work center record; also place the value "WORK CENTER" here
2	SELECT		Report selection All selections (no deferred or finished)
3	SEQUENCE		AWC only
4	STD-HD3-TITLE STD-TRL2-TITLE		Place the value "SCHEDULING GANTT CHART" here
5	JCN	JOB-JCN	Job control number
6	Noun name	JOB-NOUN-NAME	Description of the job
7	Iden No.	JOB-IES-NR	Identification/Equipment Serial Number
8	Kop	KOP-KOP-NR	Key operation number ranges from 001 to 999; makes the kops unique
9	Description	KOP-DESC	Describes the key operation

Item Number	Column Heading	Input Mnemonic	Description of Data
10	Week SS SC	KOP-SW KOP-CW	Week SS is the scheduled start week of the kop; week SC is the scheduled completion week of the kop; if one is present, you must have the other.
11	M/H Est	KOP-MHEST	Man-hours estimated to complete the kop; value determined by the following formula: MAN-HOURS ESTIMATED = MAN-HOURS USED TO DATE + MAN-HOURS REMAINING
12	PRI-	JOB-PRI	Job priority ranges from 1 to 4; job priority is entered by the work center supervisor
13	KE:	JOB-KEV	Contains the key event code; all key event codes entering the system must match the key event table; maximum 999 key events.
14	Kop Kev	KOP-KEV	Key event entered by PERA or the SHIP; all the key events must match the key event table
15	QA	KOP-QA	The data is entered by the Ship or PERA
16			Month and Sunday date of a week in a 16-week period in the availability
17			Number of each week relative to the beginning of the availability
18			Have to print dashes; they represent the separation of jobs
19	AWC	KOP-AWC	Accomplishing work center
20	Compartment	KOP-CMPT-NR	Field is broken down by deck frame, use; an alpha character in leftmost position, then the field will not be considered as a unit and not separated into the deck, frame, use field; if other than alpha, the fields will be broken down and separated by (-) when they are printed



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WORK CENTER                                  USS HARRY W. HILL (DD 986)

                                             FLEET MANAGEMENT SYSTEM - RT                       OVHL START 17 NOV 85

SEQUENCE:   AWC/JCN/KOF                      WORK LIST/MATERIAL                                 OVHL COMPL 16 NOV 96

PROG/  I--JCN--I  I--NOUN NAME---I  I-IDENT  NO-I                  WEEK  M/H  WEEK  TOT  M/H  Q  SCREEN  MISSN  INSURV   ESWBS/JCN
WGHT              AWC   KOF   I----DESCRIPTION----I   COMPARTMENT  SS SC EST  USED  USED REMN A          ESNTL  NUMBER

100%   CSE1-1096  AN/SPA 25E      1212            PRI-3        RMKS:  REPEATER NEEDS INSTALL IMMEDIA   SY/SF   ME101   290230P  63113-01N
DONE              CSE1    1   INSTL/TEST REPEATER   03-140-0Q    23 25   300   10   200       A
                   LIN    DOC NO    I------NSN------I   NOMENCLATURE  QTY     QTY  QTY  QTY   MATERIAL STATUS:
                                                                      ORD  UI RECD ISS  CAN
                   001   5217F420  9Q5120000012305     CABLES          3   SE   2    2    2   CANCEL QTY REORDERED 5261F931Q
                   002   5217F421  9Q5120000012307     CABLES          2   SE   2    2        NSN SUBSITUTED
                   003   5217F931  9Q5120000012305     CABLES          1   SE                 REORDER

       CSE1-F007  SA-1981/SP        A-27          PRI-2 KE:4257  RMKS:  DISCREPANCIES             SF(OPT)          280230P  45011-030
50%               CSE1    1   RPR 20V PWR SPLY      03-154-02Q   02 14    8              8          ATTN:  NOT STARTED
30%               CSE1    2   RPL RES/FUHLR/HDW     03-154-02Q   02 09    4              2          ATTN:  NOT COMPLETED
20%               CSE1    3   OPTEST                BULKHEAD     02 19    2              2          ATTN:  NOT STARTED


40%    CSE1-P008  PAINTING                        PRI-3        RMKS:  OAC PAINT CRACKED                                290230P  63113-020
DONE              CSE1    1   PREP/PRIME            02-220-2Q    23 28    55      15  55       A
30%               YPO1    2   PAINT                 02-220-2Q    28 28     5              5
30%               CSE1    3   CLEAN UP/STENCIL      02-220-2Q    29 29     6              6

                                                                      QTY      QTY  QTY  QTY
                   LIN    DOC NO    I------NSN------I   NOMENCLATURE  ORD  UI  RECD ISS  CAN  MATERIAL STATUE:
                   001   5218F388  9Q8010005774739     FORM 124       10   CN
                   002   5218F389  9Q8010001658574     FORM 116       10   CN   11    5    1   EXCESS RECEIVED
                   003   5218F390  9Q8010002854870     FORM 20L        1   GL
                   004   5218F391  9Q8010004376757     PRIMER          5   KT

40%   CSE1-P009 TILE                              PRI-4        RMKS:  TILE DETERIORATED                                290230P  63411-211
DONE      KE:0560   CSE1    1   PREP DECK           02-220-2Q    28 29     6         6           A
50%       KE:0560   YF01    2   TILE                02-220-2Q    28 29     6           6
10%       KE:0560   CSE1    3   CLEAN UP            02-220-2Q    29 29     6           1

                                                                      QTY      QTY  QTY  QTY
                   LIN    DOC NO    I------NSN------I   NOMENCLATURE  ORD  UI  RECD ISS  CAN  MATERIAL STATUS:
                   001             9Q7220001445034     GREEN TILE      3   BX                 BULK ORDERED 5218F394
                   002             9Q8040005824596     ADHESIVE        2   GL                 BULK ORDERED 5219F395




                 TITLE:  WORK LIST/MATERIAL                                          RUN DATE/TIME 19 DEC 85 01:00
PAGE 1    REPORTING LEVEL:CSE1 WORK CENTER                                           FILE DATE/TIME 18 DEC 85 01:10
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2. Work List/Material

a. Material Information

- Line Item Number
- Document Number (TYCOM fund code– 5th position)
- National Stock Number (first two positions are the COG code)
- Nomenclature
- Quantity Ordered
- Unit of Issue
- Quantity Received
- Quantity Issued
- Quantity Canceled
- Material Status

b. Report Design

The report is produced in originating work center sequence. The report can be produced for the following data categories:

- All jobs regardless of status
- All active jobs
- All inactive jobs and/or keyops
- Mission essential jobs
- Deferred jobs only

Headers and trailers are standard (except report title and selection data. When a job line is printed, it will be followed by its kop information and associated material information. Computed items are the following:

- Job physical progress
- KOP current man-hours remaining

c. Report Selection

The report can be produced for a single OWC, a range of OWCs, or a string of OWCs.

d. Field Descriptions

Descriptions are as follows:

Item Number	Column Heading	Input Mnemonic	Description of Report Elements
1	STD-HDR1-WC STD-TRL2-REPORT LEVEL	WC-WC	Work center designators Work center code is from the work center record; also place the value "WORK CENTER" here
2	SEQUENCE		Sequence is OWC
3	STD-HD3-TITLE STD-TRL2-TITLE		Place the value "WORK/LIST MATERIAL" here
4	PROG/WGHT	JOB-PHY-PROG	Physical Progress of a job is the sum of the weight of its finished kops
		KOP-PHY-PROG	KOP Physical Progress is the weight of the kops; when kop is finished its weight is added to the job line and the work "DONE" is printed in its place on the kop line
5	JCN	JOB-JCN	Job control number
6	NOUN NAME	JOB-NOUN-NAME	Description of the job
7	IDENT NO.	JOB-IES-NR	Identification/Equipment Serial Number

8	Week SS SC	KOP-SW KOP-CW	Week SS is the scheduled start week of the kop; week SC is the scheduled completion week of the kop

Item Number	Column Heading	Input Mnemonic	Description of Report Elements
9	M/H EST	KOP-MHEST	Man-hours estimated to complete the kop; value determined by the following formula: MAN-HOURS ESTIMATED = MAN-HOURS USED TO DATE + MAN-HOURS REMAINING
10	TOT USED	KOP-CUM-MHUSED	Sum of all man-hours used on the kop
11	M/H REMN	KOP-CUR-MHREMN (calculation)	Man-hours remaining is calculated by subtracting KOP-CUM-MHUSED from KOP-CUR-MHEST, which gives the KOP-CUR-MHREMN field
12	QA	KOP-QA	The data is entered by PERA or by the Ship
13	SCREENING	JOB-SCREEN	This is a comment entered by PERA or by the Ship
14	MISSN ESNTL	JOB-ME-CD	Mission essential code identifies a job as mission essential; it consists of the department code and a three-digit number ranging from 100 to 199; mission essential jobs must stay in active status until the mission essential code is changed
15	INSURV NUMBER	JOB-INSURV	Inspection and survey INSURV (used by SARP)
16	ESWBS/JON	JOB-ESWBS-JON	Expanded ship work breakdown structure formerly known as SWLIN (SARP) JON private shipyard job order number used by private shipyards
17	AWC	KOP-AWC	Work center that will do the work on the kop; all AWCs entering the system will have to match the work center table;

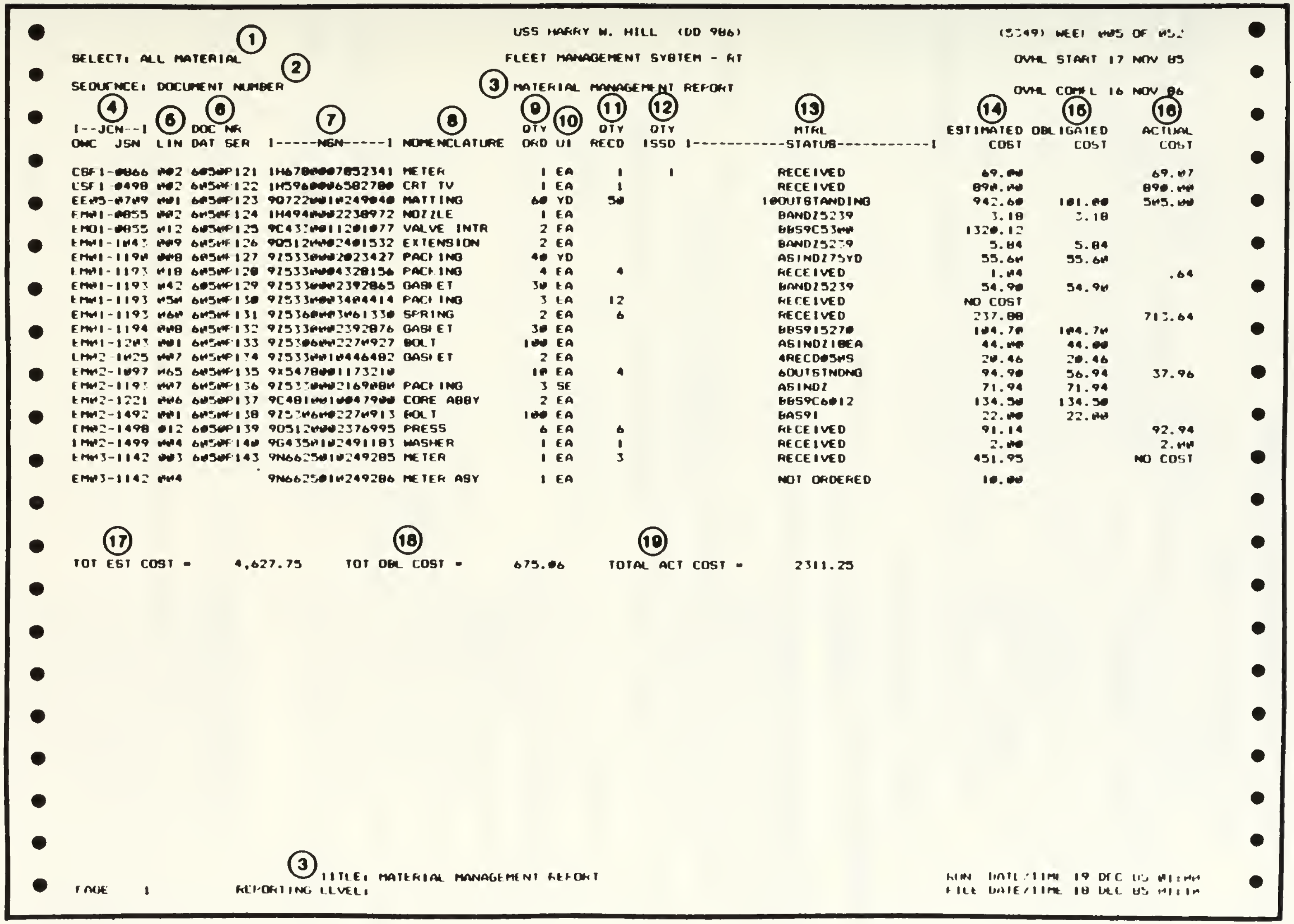
			kops with man-hours expended against it will not be able to change their AWC
18	KOP	KOP-KOP-NR	Key operation number ranges from 001 to 999; makes the kops unique

Item Number	Column Heading	Input Mnemonic	Description of Report Elements
19	DESCRIPTION	KOP-DESC	Description of the key operation
20	COMPARTMENT	KOP-CMPT-NR	Field is broken down by deck frame, use; an alpha character in leftmost position means this is a comment field and will not be separated; any other type character in leftmost position; the fields will be broken down and separated by (-) when they are printed
21	PRI-	JOB-PRI	Job priority ranges from 1 to 4; job priority is entered by the work center supervisor
22	RMKS	JOB-REMARKS	Comments pertaining to the job entered by PERA or the Ship
23	LIN	MTRL-LN-NR	The line Number contains a number generated by the computer that is used to identify material records when no document number has been assigned; this number comes from the Next Available Line Item Number field in the job record; line numbers cannot be changed or reused
24	DOC NO.	MTRL-DOC-NR	The Document Number is a unique number that is assigned by the supply officer at the time material is ordered; the fifth position is the TYCOM Fund Code
25	NSN	MTRL-NSN	Uniquely identifies the material in the supply system (national stock number); positions 1 and 2 of this field make up the COG code

Item Number	Column Heading	Input Mnemonic	Description of Report Elements
26	NOMENCLATURE	MTRL-NOMEN	Description of the material itself (e.g., nut, bolt, paintbrush)
27	QTY ORD	MTRL-QTY-REQD	Quantity of material required to do the job; used with the unit price field to produce the extended estimated cost which becomes obligated cost when material is ordered
28	UI	MTRL-UI	The Unit of Issue code describes the lowest unit that can be issued or purchased (e.g., EA=each; BS=box; CN=carton, etc.)
29	QTY RECD	MTRL-QTY-RCVD	Contains a count of the material items received to date
30	QTY ISS	MTRL-QTY-ISS	Contains the number of material items issued to the work center
31	QTY CAN	MTRL-QTY-CAN	Contains the number of material items cancelled
32	MATERIAL STATUS	MTRL-STAT	Contains either a status code which can be interpreted by a status look-up table or a 30-character comment if code does not match look-up table; it will be treated as a comment
33	KE:	JOB-KEV	Contains the job key event code; all key event codes entering the system must match the key event table; maximum 999 key events
34	ATTN:	KOP-ATTN	Comment field; three messages are system generated: "NOT STARTED," "NOT COMPLETED," OR "NOT SCHEDULED." These messages will appear when the following conditions exist: a kop schedule start on schedule complete week has passed without man-hours being expended and the overhaul has begun and the kop is NOT

YET SCHEDULED, however the ship can override their messages

Item Number	Column Heading	Input Mnemonic	Description of Report Elements
35		JOB-PSYD-JON	Private shipyard job order number used by shipyard; three-character field that follows the ESWBS
36	KE:	KOP-KEV	Key event; entered by PERA or the Ship; all key events must match the key event table
37	WEEK USED		Number of man-hours used the previous week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                                                      USS HARRY W. HILL  (DD 986)                                        (5349) WEEK 005 OF 052
SELECT: ALL MATERIAL                                 FLEET MANAGEMENT SYSTEM - RT                                        OVHL START 17 NOV 85
SEQUENCE: DOCUMENT NUMBER                            MATERIAL MANAGEMENT REPORT                                          OVHL COMPL 16 NOV 86
I--JCN--I       DOC NR                                           QTY     QTY  QTY              MTRL                ESTIMATED OBLIGATED   ACTUAL
OWC   JSN  LIN  DAT SER  I-----NSN-----I NOMENCLATURE   ORD UI  RECD ISSD I-----------STATUS-----------I    COST      COST       COST

CBF1-0066 002 6050P121 1H6700007052341 METER            1 EA    1    1          RECEIVED                 69.00                69.07
CSF1-0498 002 6050P122 1H5960006582700 CRT TV           1 EA    1               RECEIVED                890.00               890.00
EE05-0709 001 6050P123 907220010249040 MATTING         60 YD   50              10OUTSTANDING            942.60    101.00     505.00
EM01-0055 002 6050P124 1H4940002238972 NOZZLE           1 EA                    BANDZ5239                 3.18      3.18
EMO1-0055 012 6050P125 9C4330011201077 VALVE INTR       2 EA                    BB59C5300              1320.12
EM01-1043 009 6050P126 905120002401532 EXTENSION        2 EA                    BANDZ5239                 5.84      5.84
EM01-1190 008 6050P127 9Z5330002023427 PACKING         40 YD                    ASINDZ75YD               55.60     55.60
EM01-1193 018 6050P128 9Z5330004328156 PACKING          4 EA    4               RECEIVED                  1.04                  .64
EM01-1193 042 6050P129 9Z5330002392065 GASKET          30 EA                    BANDZ5239                54.90     54.90
EM01-1193 050 6050P130 9Z5330003404414 PACKING          3 EA   12               RECEIVED                NO COST
EM01-1193 060 6050P131 9Z5360003061330 SPRING           2 EA    6               RECEIVED                237.88               713.64
EM01-1194 008 6050P132 9Z5330002392076 GASKET          30 EA                    BB5915270               104.70    104.70
EM01-1203 001 6050P133 9Z5306002270927 BOLT           100 EA                    ASINDZ10EA               44.00     44.00
EM02-1025 007 6050P134 9Z5330010446482 GASKET           2 EA                    4RECD050S                20.46     20.46
EM02-1097 065 6050P135 9X5470001173210                 10 EA    4               6OUTSTNDNG               94.90     56.94      37.96
EM02-1193 007 6050P136 9Z5330002169080 PACKING          3 SE                    ASINDZ                   71.94     71.94
EM02-1221 006 6050P137 9C4810010047900 CORE ASSY        2 EA                    BB59C6012               134.50    134.50
EM02-1492 001 6050P138 9Z5306002270913 BOLT           100 EA                    BAS91                    22.00     22.00
EM02-1498 012 6050P139 905120002376995 PRESS            6 EA    6               RECEIVED                 91.14                92.94
EM02-1499 004 6050P140 9G4350102491183 WASHER           1 EA    1               RECEIVED                  2.00                 2.00
EM03-1142 003 6050P143 9N6625010249285 METER            1 EA    3               RECEIVED                451.95              NO COST

EM03-1142 004          9N6625010249286 METER ASY        1 EA                    NOT ORDERED              10.00


TOT EST COST =     4,627.75    TOT OBL COST =     675.06    TOTAL ACT COST =      2311.25



                                 TITLE: MATERIAL MANAGEMENT REPORT                                   RUN  DATE/TIME 19 DEC 85 01:00
PAGE    1              REPORTING LEVEL:                                                              FILE DATE/TIME 18 DEC 85 01:10
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4. Material Management Report

a. Report Narrative

Material Management Report displays the status of material, quantity ordered, quantity received, quantity issued, and accounting data for FMS-RT funds.

b. Report Design

The report may be obtained in the following sequences:

- Job Control Number (JCN)
- National Stock Number (NSN)
- Document/Requisition Number (DOC)
- Type Commander Fund Code (TYCOM FUND CODE) (with secondary sequence on document/requisition number)

The report may be produced for the following data categories:

- All material
- All requisitioned material
- All outstanding material
- All material not requisitioned

Headers and trailers are standard. Material items without document numbers sort at the end of the report when requested in that sequence.

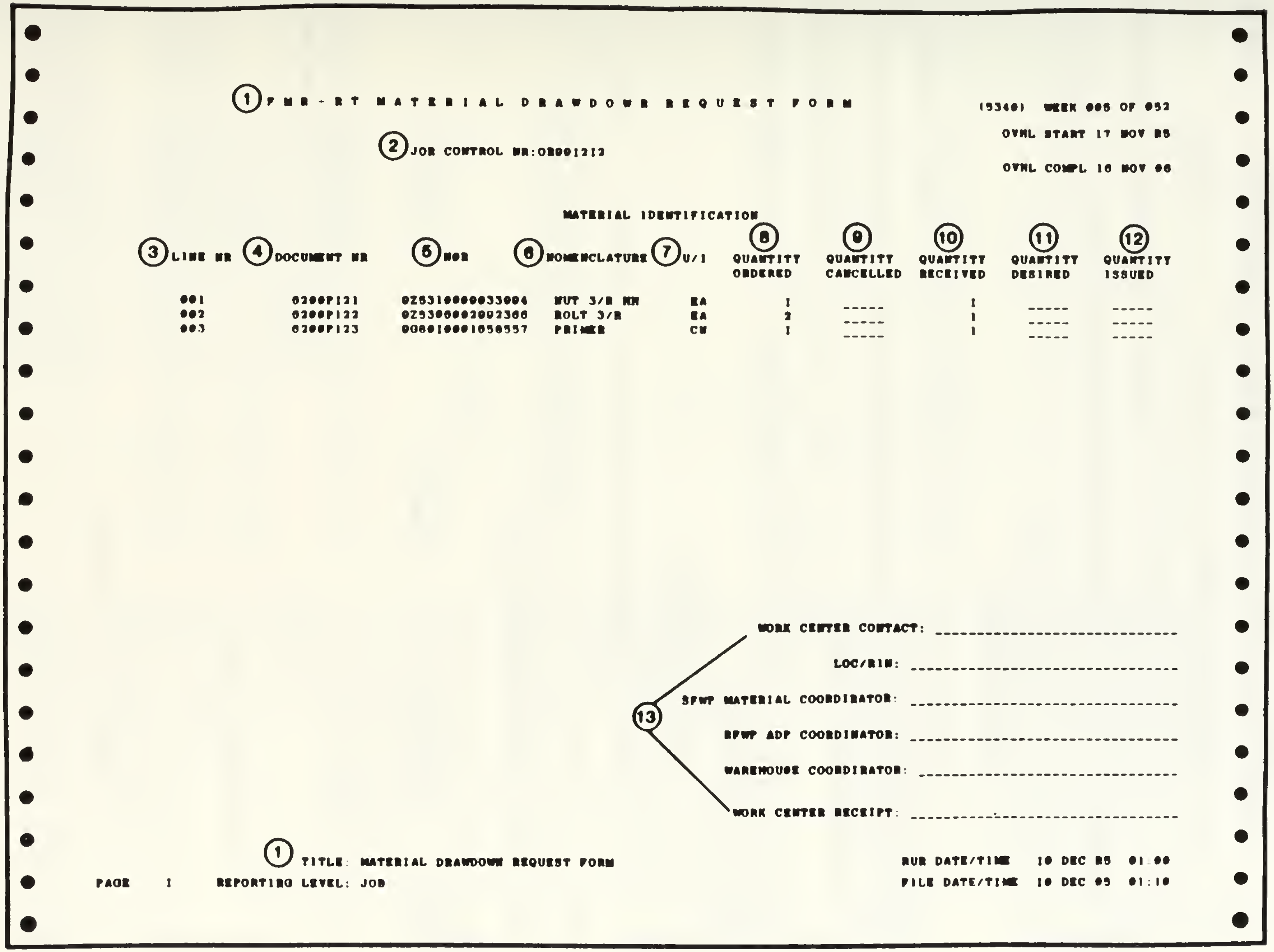
c. Report Selection

The report can be produced for a single work center or for all work centers.

d. Field Descriptions

Item Number	Column Heading	Input Mnemonic	Description of Data
1	SELECT	STD-HDR2-SELECT	A description of the data selected to appear on the report
2	SEQUENCE	STD-HDR3-SEQUENCE	A description of the report sequence
3	TITLE	STD-HDR3-TITLE	Move "material management report" to this field
4	JCN	MTRL-JCN	Job control number
5	LIN	MTRL-LN-NR	Line item number assigned by computer
6	DOC NR DAT SER	MTRL-DOC-NR	Material document number; the number under which the item was ordered
7	NSN	MTRL-NSN	National stock number
8	Nomenclature	MTRL-NOMEN	Name of part
9	QTY ORD	MTRL-QTY-REQ	Quantity ordered
10	UNIT OF ISSUE	MTRL-UI	Units in which material is dispensed
11	QTY RECD	MTRL-QTY-RCVD	Quantity received
12	QTY ISSD	MTRL-QTY-ISS	Quantity issued
13	MTRL STATUS	MTRL-STAT	Status of material
14	ESTIMATED COST	MTRL-EXTD-EST-COST	Net estimated cost of each line item
15	OBLIGATED COST	MTRL-OBL-COST	To have any data shown in this field, a document number must be present; if no material has been received, then obligated cost equals estimated cost; upon receipt of material, obligated cost is decreased by the entry of actual cost data; obligated cost will equal zero upon receipt of all ordered material

Item Number	Column Heading	Input Mnemonic	Description of Data
16	ACTUAL COST	MTRL-ACTL-COST	Net cost as returned in billing
17	TOTAL EST COST	N/A	Total estimated cost of all material items for the specific sequence ordered
18	TOTAL OBL COST	N/A	Total obligated cost of all material items
19	TOTAL ACT COST	N/A	Total actual cost of all material items



① FMR-RT MATERIAL DRAWDOWN REQUEST FORM

(5340) WEEK 005 OF 052

OVHL START 17 NOV 85

OVHL COMPL 16 NOV 86

② JOB CONTROL NR:0R001212

MATERIAL IDENTIFICATION

③ LINE NR	④ DOCUMENT NR	⑤ NSN	⑥ NOMENCLATURE	⑦ U/I	⑧ QUANTITY ORDERED	⑨ QUANTITY CANCELLED	⑩ QUANTITY RECEIVED	⑪ QUANTITY DESIRED	⑫ QUANTITY ISSUED
001	0200P121	0Z53100000033004	NUT 3/8 NH	EA	1	-----	1	-----	-----
002	0200P122	0Z53060002092366	BOLT 3/8	EA	2	-----	1	-----	-----
003	0200P123	0G8010001050557	PRIMER	CN	1	-----	1	-----	-----

⑬

WORK CENTER CONTACT: ______________________________

LOC/BIN: ______________________________

SFWP MATERIAL COORDINATOR: ______________________________

SFWP ADP COORDINATOR: ______________________________

WAREHOUSE COORDINATOR: ______________________________

WORK CENTER RECEIPT: ______________________________

① TITLE: MATERIAL DRAWDOWN REQUEST FORM

PAGE 1 REPORTING LEVEL: JOB

RUN DATE/TIME 10 DEC 85 01:00

FILE DATE/TIME 10 DEC 85 01:10

5. Report—Material Drawdown Request Form

a. Report Narrative

The Material Drawdown Request Form report is used to draw supplies from the ship's supply storeroom. Material for each job will be printed on a separate page.

b. Report Design

The report can only be obtained by Job Control Number. Only material with a document/requisition number will appear on this report. The material items on the report are in document/requisition number sequence. Report headers are unique to this report. Report trailers are standard.

c. Report Selection

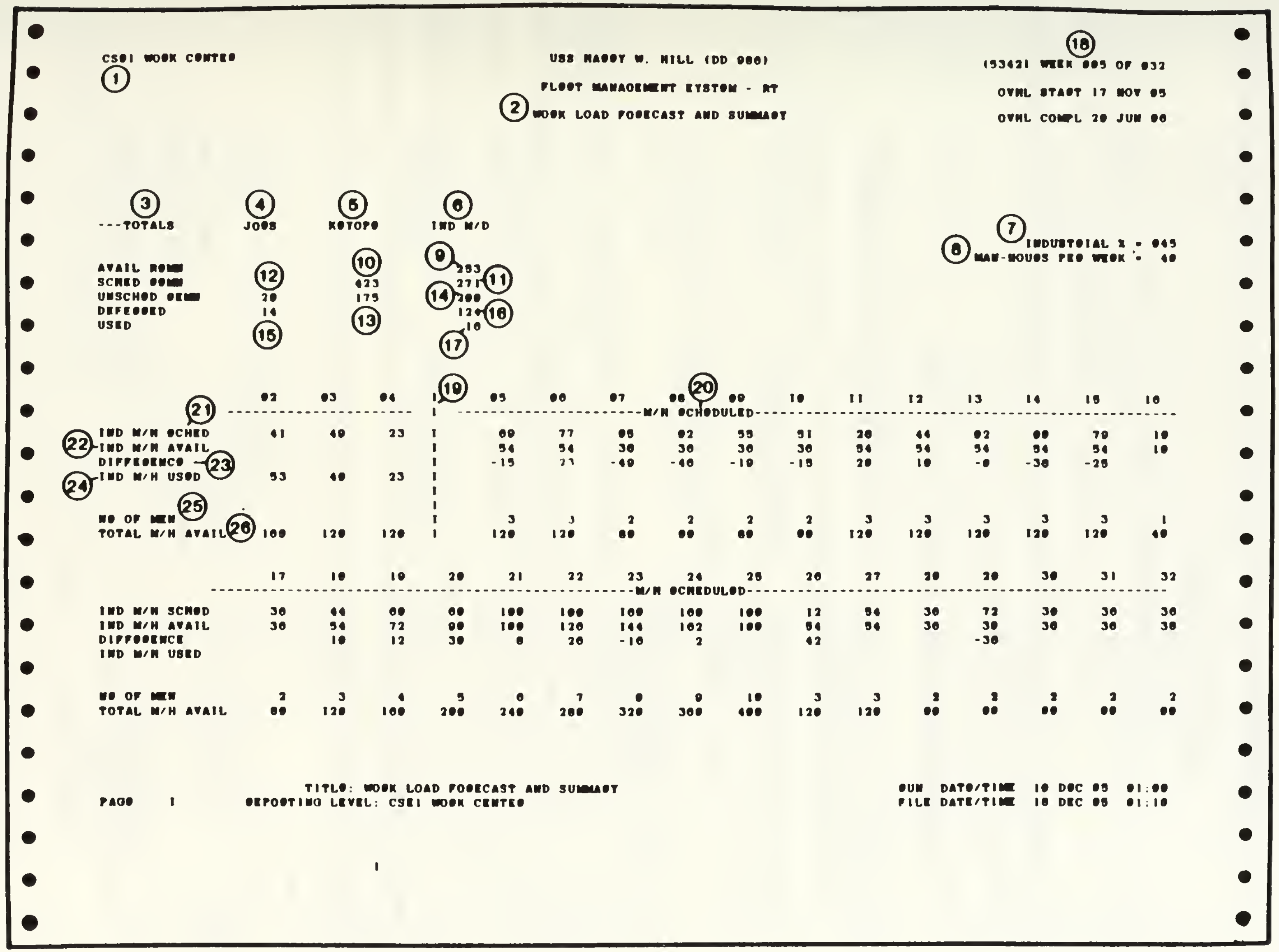
The report may be produced for a single job number, a string of job numbers, a group of job numbers, or all job numbers.

d. Field Descriptions

Item Number	Column Heading	Input Mnemonic	Identification of Data
1	NON-STD-HD3-TITLE		Move the title of the report to this item; in this case, it would be "FMS-RT Material Drawdown Request Form," which is not a standard header
	STD-TRL1-TITLE		Move the title of the report to this item; in this case, it would be "FMS-RT Material Drawdown Request Form"
2	JOB CONTROL NR	JOB-JCN	The Job Control Number is assigned by the Originating Work Center; it uniquely identifies jobs; it is composed of the Originating Work Center and Job Sequence Number

Item Number	Column Heading	Input Mnemonic	Identification of Data
3	LINE NR	MTR-LN-NR	The Line Number contains a number generated by the computer that is used to identify material records when no document number has been assigned; this number comes from the Next Available Line Item Number field in the job record; line numbers cannot be changed or reused.
4	DOCUMENT NR	MTRL-DOC-NR	The Document Number is a unique number that is assigned by the supply officer at the time material is ordered; the fifth position is the TYCOM Fund Code
5	NSN	MTRL-NSN	This is the National Stock Number, which uniquely identifies the material in the supply system; the first two characters of the NSN are the (COG Code); the Cognizance Code identifies the inventory manager for the material
6	NOMENCLATURE	MTRL-NOMEN	Description of the material itself (e.g., nut, bolt, paintbrush)
7	U/I	MTRL-UI	The Unit of Issue code describes the lowest unit that can be issued or purchased (e.g., EA=each; BX=box; CN=carton, etc.)
8	QUANTITY ORDERED	MTRL-QTY-ORD	This number is used to show the quantity of material required to do the job
9	QUANTITY CANCELLED	MTRL-QTY-CAN	Number of material items that were cancelled
10	QUANTITY RECEIVED	MTRL-QTY-RCVD	This is the number of material items received to date by the ship's supply officer
11	QUANTITY DESIRED	N/A	Quantity Desired is the amount of material items needed by the work center supervisor at this time

Item Number	Column Heading	Input Mnemonic	Identification of Data
12	QUANTITY ISSUED	MTRL-QTY-ISS	Quantity issued is the number of material items issued to the work center supervisor
13	WORK CENTER CONTACT LOC/BIN SFWP Material Coordinator SFWP ADP Coordinator SFWP ADP Coordinator Warehouse Coordinator Work Center Receipt		The work center's supervisor and the supply coordinator's signature go on the appropriate lines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CS01 WORK CENTER                         USS HARRY W. HILL (DD 986)                        (53421) WEEK 005 OF 032

                                       FLEET MANAGEMENT SYSTEM - RT                        OVHL START 17 NOV 85

                                       WORK LOAD FORECAST AND SUMMARY                      OVHL COMPL 28 JUN 86



---TOTALS          JOBS      KSTOPS      IND M/D
                                                                                              INDUSTRIAL % = 045
AVAIL REMM                                 253                                            MAN-HOURS PER WEEK =  40
SCHED REMM                     423         271
UNSCHED REMM        20         175         200
DEFERRED            14                     124
USED                                        16


                     02     03     04   I   05     06     07     08     09     10     11     12     13     14     15     16
                   ---------------------I  -----------------------M/H SCHEDULED------------------------------------------
IND M/H SCHED        41     40     23   I   69     77     85     82     55     51     28     44     62     84     79     18
IND M/H AVAIL                           I   54     54     36     36     36     36     54     54     54     54     54     18
DIFFERENCE                              I  -15    -23    -49    -46    -19    -15     26     10     -8    -30    -25
IND M/H USED         53     40     23   I
                                        I
                                        I
NO OF MEN                               I    3      3      2      2      2      2      3      3      3      3      3      1
TOTAL M/H AVAIL     160    120    120   I  120    120     80     80     80     80    120    120    120    120    120     40

                     17     18     19     20     21     22     23     24     25     26     27     28     29     30     31     32
                   -----------------------------------------------M/H SCHEDULED------------------------------------------
IND M/H SCHED        36     44     60     60    100    100    160    160    180     12     54     36     72     36     36     36
IND M/H AVAIL        36     54     72     90    108    126    144    162    180     54     54     36     36     36     36     36
DIFFERENCE                  10     12     30      8     26    -16      2            42                  -36
IND M/H USED

NO OF MEN             2      3      4      5      6      7      8      9     10      3      3      2      2      2      2      2
TOTAL M/H AVAIL      80    120    160    200    240    280    320    360    400    120    120     80     80     80     80     80


                         TITLE: WORK LOAD FORECAST AND SUMMARY                         RUN  DATE/TIME  18 DEC 85  01:00
PAGE    1            REPORTING LEVEL: CS01 WORK CENTER                                 FILE DATE/TIME  18 DEC 85  01:10
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6. Workload Forecast and Summary Report Specifications

a. Report Narrative

The purpose of this report is to provide the work center supervisor with a detailed short-range or long-range view of his available manpower versus scheduled work. In addition, the report provides a summary in man-days of the following:

- Remaining man-days available to do work
- Remaining work (in man-days) that has been scheduled
- Remaining work (in man-days) that has not been scheduled
- Work (in man-days) that has been deferred
- Work (in man-days) that has been accomplished to date

b. Report Design

The report is produced in accomplishing work center sequence. Reports can be selected by individual work centers and/or departments, or they can be selected by a range of work centers and/or departments. In addition, the report can be selected by a range of weeks beginning with the current week or beginning with a week in the future. Report selections for weeks earlier than the current week are invalid.

Item Number	**Column Heading**	**Input Mnemonic**	**Description of Report Element**
1	STD-HDR1-REPORT LEVEL STD-TRL2-REPORT LEVEL	WC-WC WC-WC	Work center designation Work center code is from the work center record; also place the value "WORK CENTER" here
2	STD-HD3-TITLE STD-TRL1-TITLE	N/A N/A	Place the value "WORK LOAD FORECAST AND SUMMARY" here

Item Number	Column Heading	Input Mnemonic	Description of Report Element
3	TOTALS	N/A	Category of totals at the work center level
4	JOBS	N/A	Count of jobs that are unscheduled or deferred
5	KEYOPS	N/A	Count of keyops that are scheduled and unfinished, and count of keyops that are unscheduled
6	IND M/D	N/A	Convert man-hours to man-days for each Total Category
7	INDUSTRIAL %	WC-IND-PCT-CNSTNT	Percentage of TOTAL M/H AVAIL per week that will be used for IND M/H AVAIL
8	MAN-HOURS PER WEEK	WC-MH-PER-WK	The number of man-hours per week that each man is scheduled to work
9	AVAIL REMN (IND M/D)	WC-MHAVAIL	This is a calculation of the number of man-days available from the current week of overhaul to the end of overhaul; formula: WC-MHAVAIL/8 = AVAIL REMN
10	SCHED REMN (KEYOPS)	WC-ACTV-KOP-CNT	This is a count of the number of scheduled key operations that are not finished or deferred
11	SCHED REMN (IND M/D)	WC-MHSCHED	This is a calculation of the number of man-days scheduled; deferred and/or finished man-days are not included; formula: WC-MHSCHED = SCHED REMN (IND M/D)
12	UNSCHED REMN (JOBS)	WC-INACTV-JOB-CNT	This is a count of the number of jobs that are unscheduled and not deferred
13	UNSCHED REMN (KEYOPS)	WC-INACTV-KOP-CNT	This is a count of the number of key operations that are unscheduled and not deferred

Item Number	Column Heading	Input Mnemonic	Description of Report Element
14	UNSCHED REMN (IND M/D)	WC-MHEST WC-MHSCHED	This is a calculation of the number of unscheduled man-days; deferred man-days are not included; formula: WC-MHEST – WC-MHSCHED/8 = UNSCHED REMN (IND M/D)
15	DEFERRED (JOBS)	WC-DFR-JOB-CNT	This is a count of the number of jobs that have been deferred
16	DEFERRED (IND M/D)	WC-MHDFR	This is a count of the number of man-days that have been deferred; formula: WC-MHDFR/8 = DEFERRED (IND M/D)
17	USED (IND M/D)	WC-MHUSED	This is a calculation of the number of man-days that have been used; formula: WC-MHUSED/8 = USED (IND M/D)
18	N/A	N/A	Week of overhaul
19	N/A	N/A	I-LINE; weeks on the left of the I-LINE are history; the week to the immediate right of the I-LINE is the current week; all other weeks to the right of the I-LINE represent the future
20	N/A	N/A	Title "M/H SCHEDULE" all data below this line are in man-hours
21	IND M/H SCHED	KOP-SW KOP-CW KOP-CUR-MHREMN KOP-WK-N1-MHSCHED KOP-WK-N2-MHSCHED KOP-WK-N3-MHSCHED	

This is a calculation, by week, of all remaining man-hours scheduled in the work center. Deferred jobs are not included. Only key operations that meet the selection criteria for the report will be used. The man-hours remaining (KOP-CUR-MHREMN) for each key operation are pro-rated within the range of its start and completion weeks. The pro-rated man-hours are then added to their respective week counters in an array of schedule week counters. When the hours for all key operations have been added to the array of industrial man-hours scheduled counters, the array is printed on the report to the right of the I-LINE (see NOTE for an explanation of key operation scheduling and bow-waving). Historical data will not be printed on the report unless the current week (where current week is greater than 1) and the

I-LINE is also printed. When historical data is printed, calculations are as follows:

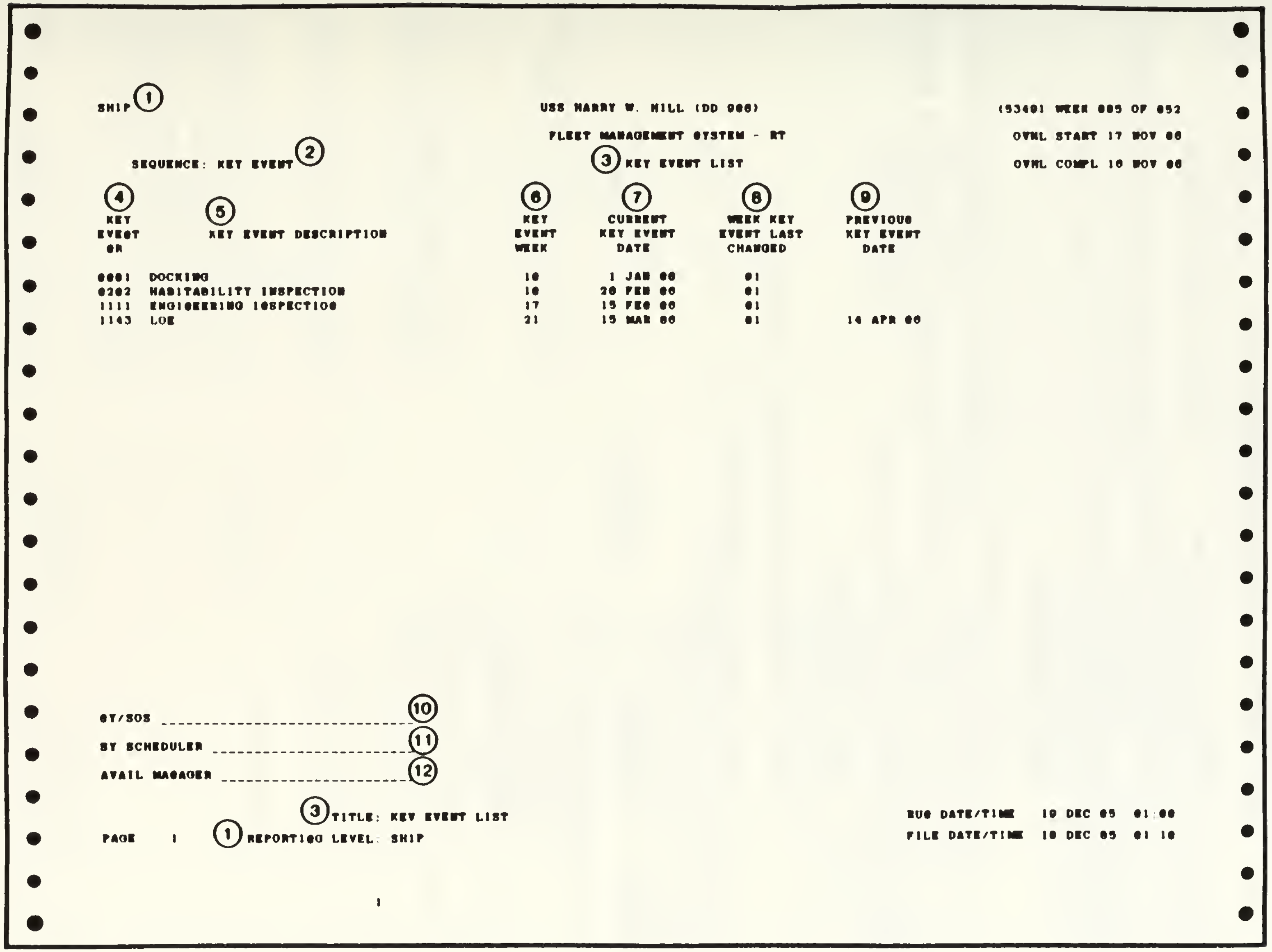
For each selected key operation, man-hours scheduled for the three weeks prior to the current week (KOP-WK-N1-MHSCHED, KOP-WK-N2 MHSCHED, KOP-WK-N3-MHSCHED) are added to their respective week counters in an array of industrial man-hours scheduled counters. The array is then printed on the report to the left of the I-LINE.

Item Number	Column Heading	Input Mnemonic	Description of Report Element
22	IND M/H AVAIL	WC-MH-PER-WK WC-IND-PCT-CNSTNT WC-NR-MEN-WK	With the exception of weeks in the past, this calculation is made for each week of the overhaul. The calculation is as follows: for each week multiply TOTAL M/H AVAIL (subscripted) by (INDUSTRIAL % x .01), giving IND M/H AVAIL (subscripted) or WC-NR-MEN-WK (subscripted) x (WC-IND-PCT-CNST x WC-MH-PER-WK x .01)
23	DIFFERENCE	IND M/H SCHED IND M/H AVAIL	With the exception of weeks in the past, this calculation is made for each week of the overhaul; the calculation is as follows: subtract IND M/H SCHED (subscripted) from IND M/H AVAIL subscripted); negative totals are acceptable
24	IND M/H USED	KOP-WK-N1-MHUSED KOP-WK-N2-MHUSED KOP-WK-N3-MHUSED KOP-MHUSED-THIS-WK	

This calculation is made for the current week and the three previous weeks; for each selected key operation. Man-hours used for the current week (KOP-MHUSED-THIS-WK) and for the three weeks prior to the current week (KOP-WK-N1-MHUSED, KOP-WK-N2-MHUSED, KOP-WK-N3-MHUSED) are added to their respective counters in an array of Man-Hours Used counters; the array is then printed on the report to the left and immediate right of the I-LINE.

Item Number	Column Heading	Input Mnemonic	Description of Report Element
25	NR OF MEN	WC-NR-MEN-WK	This element is not printed for weeks in the past; for each week, print the value found in men count per week (WC-NR-MEN-WK) (subscripted)

Item Number	Column Heading	Input Mnemonic	Description of Report Element
26	TOTAL M/H AVAIL	WC-NR-MEN-WK WC-MH-PER-WK	This calculation is made for the current week, the three previous weeks, and for future weeks; for each week, multiply the number of men per week by the man-hours per work week constant or WC-NR-MEN-WK (subscripted) x WC-MH-PER-WK = Total M/H AVAIL (subscripted)



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SHIP①                                     USS HARRY W. HILL (DD 986)                     (53401 WEEK 005 OF 052

                                          FLEET MANAGEMENT SYSTEM - RT                    OVHL START 17 NOV 86

    SEQUENCE: KEY EVENT②                       ③KEY EVENT LIST                            OVHL COMPL 16 NOV 86

 ④                                        ⑥         ⑦          ⑧           ⑨
 KEY           ⑤                          KEY     CURRENT    WEEK KEY    PREVIOUS
EVENT     KEY EVENT DESCRIPTION          EVENT   KEY EVENT  EVENT LAST   KEY EVENT
 NR                                      WEEK      DATE      CHANGED       DATE

0001  DOCKING                             16      1 JAN 86     01
0202  HABITABILITY INSPECTION             16     20 FEB 86     01
1111  ENGINEERING INSPECTION              17     15 FEB 86     01
1143  LOE                                 21     15 MAR 86     01        14 APR 86




SY/SOS ________________________________⑩
SY SCHEDULER __________________________⑪
AVAIL MANAGER _________________________⑫
                           ③TITLE: KEY EVENT LIST                              RUN DATE/TIME   19 DEC 85  01:00
PAGE    1          ①REPORTING LEVEL: SHIP                                      FILE DATE/TIME  18 DEC 85  01 10

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7. Key Event List Report Specification

a. Report Narrative

The objective of the Key Event List report is to provide a managerial tool to keep track of the occurrence of key events.

b. Report Design

The report is produced in key event number sequence or in key event date sequence. Headers and trailers are standard (except report title sequence and report level).

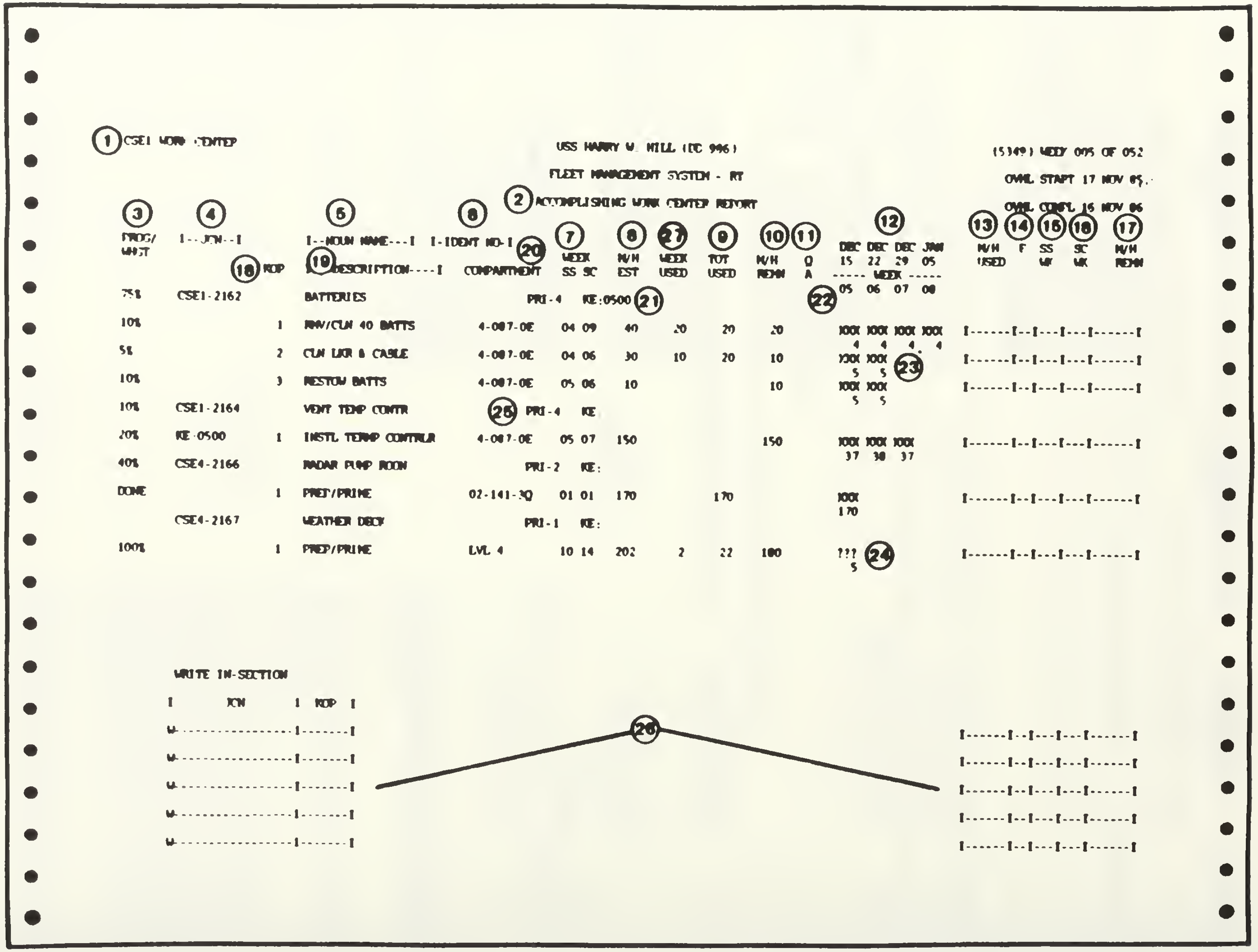
c. Report Selection

All key events are selected for this report

d. Field Descriptions

Item Number	Column Heading	Input Mnemonic	Identification of Data
1	STD-HDR1-REPORT-LEVEL STD-TRL2-REPORT-LEVEL		Move the report title to this item; in this case it is "SHIP"
2	STD-HDR3-SEQUENCE		Move the report sequence to this item; in this case it is "Key Event Number"
3	STD-HDR3-TITLE STD-TRL1-TITLE		Move the report title to these items; in this case it is "Key Event List"
4	KEY EVENT NR	KEV-KEV-CD	The KEY EVENT NR contains a four-position code obtained from the shipyard or a code arbitrarily assigned by the shipyard to represent important milestones in the overhaul period
5	KEY EVENT DESCRIPTION	KEV-DESC	This field contains a brief description of the key event

Item Number	Column Heading	Input Mnemonic	Identification of Data
6	KEY EVENT WEEK	KEV-WK	The KEY EVENT WEEK contains the week of overhaul in which the key event will occur; it is determined by using the overhaul start date and the key event date fields; obtain the difference between the dates and convert it to a week number
7	CURRENT KEY EVENT DATE	KEV-DTE-MIL	This is the date that the key event is scheduled to occur
8	WEEK KEY EVENT LAST CHANGED		The WEEK KEY EVENT LAST CHANGED field is the week the key event was last changed; to find this week, convert the modification date in the key event record to weeks
9	PREVIOUS KEY EVENT DATE	KEV-PRV-DTE-MIL	This field contains the date of the previous key event; if the key event date is changed, then the superseded date will be moved to this field prior to the change
10	SY/SOS		Reserved for the Supervisor of Shipbuilding's signature
11	SY SCHEDULER		Reserved for the Shipyard Scheduler's signature
12	AVAIL MANAGER		Reserved for the Availability Manager's signature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CSE1 WORK CENTER                          USS HARRY W. HILL (DC 996)                    (5349) WEEK 095 OF 052

                                          FLEET MANAGEMENT SYSTEM - RT                  OVHL START 17 NOV 05.

                                          ACCOMPLISHING WORK CENTER REPORT              OVHL COMPL 16 NOV 06

PROG/  I--JCN--I        I--NOUN NAME---I  I-IDENT NO-I  WEEK  M/H  WEEK  TOT   M/H   Q  DEC  DEC  DEC  JAN    M/H    F  SS  SC  M/H
WHGT                                                                              15   22   29   05     USED      WK  WK  REMN
                   KOP     DESCRIPTION----I   COMPARTMENT   SS SC  EST  USED  USED  REMN  A  ----- WEEK -----
                                                                                  05   06   07   08
75%    CSE1-2162           BATTERIES                PRI-4   KE:0500
10%                  1     RMV/CLN 40 BATTS    4-007-0E     04 09   40    20    20    20      XXXX XXXX XXXX XXXX  I------I--I---I---I------I
                                                                                     4    4    4    4
5%                   2     CLN LKR & CABLE     4-007-0E     04 06   30    10    20    10      XXXX XXXX            I------I--I---I---I------I
                                                                                     5    5
10%                  3     RESTOW BATTS        4-007-0E     05 06   10                10      XXXX XXXX            I------I--I---I---I------I
                                                                                     5    5
10%    CSE1-2164           VENT TEMP CONTR              PRI-4   KE
20%    KE 0500       1     INSTL TEMP CONTRLR  4-007-0E     05 07  150               150      XXXX XXXX XXXX       I------I--I---I---I------I
                                                                                    37   38   37
40%    CSE4-2166           RADAR PUMP ROOM              PRI-2   KE:
DONE                 1     PREP/PRIME          02-141-3Q    01 01  170          170           XXXX                 I------I--I---I---I------I
                                                                                   170
       CSE4-2167           WEATHER DECK                 PRI-1   KE:
100%                 1     PREP/PRIME          LVL 4        10 14  202     2    22   100      ???                  I------I--I---I---I------I
                                                                                     5



       WRITE IN-SECTION

       I      JCN       I  KOP  I
       W----------------I-------I                                                                                  I------I--I---I---I------I
       W----------------I-------I                                                                                  I------I--I---I---I------I
       W----------------I-------I                                                                                  I------I--I---I---I------I
       W----------------I-------I                                                                                  I------I--I---I---I------I
       W----------------I-------I                                                                                  I------I--I---I---I------I
```

8. Accomplishing Work Center Report

a. Report Narrative

The Accomplishing Work Center Report is the primary working document for the work center. During the availability, space is provided to report the number of man-hours used, completion of keyops, and changes to the scheduled start and completion weeks and man-hour estimates. Space is also provided to report man-hours used for keyops scheduled in the future.

b. Report Design

The report is produced in accomplishing work center sequence. It is selected in four-week increments beginning no earlier than the current week.

Further report specifications are as follows:

- Headers and trailers are standard
- Reports will be produced for the following data categories:
  - All jobs and keyops in progress
  - All jobs and keyops scheduled to start before and/or during the period covered by the report
  - All jobs with key operations extending beyond the overhaul completion date

c. Report Selection

The user may select a single accomplishing work center or a string of work centers, a range of work centers, or any combination of range and string. The report will display only jobs and keyops that are scheduled and not deferred or finished.

d. *Field Descriptions*

Item Number	Column Heading	Input Mnemonic	Description of Data
1	STD-HDR1-WC STD-TRL1-TITLE	WC-WC WC-WC	Work center designation Also place the value "WORK CENTER" here
2	STD-HDR3-TITLE STD-TRL2-REPORT-LEVEL	N/A	Place the value "ACCOMPLISHING WORK CENTER REPORT" here
3	PROG/WGHT	KOP-PHY-PROG	Keyop level: Assigned by the work center supervisor; an estimate of the relevance of the keyop
		JOB-PHY-PROG	Job level: Increments as keyops are completed; will never exceed 100%
4	JCN	JOB-JCN	Job control number
5	NOUN NAME	JOB-NOUN-NAME	Job title
6	INDENT NO.	JOB-IES-NR	Model or serial number MK and MOD, that identifies the equipment
7	WEEK SS SC	KOP-SW KOP-SC	Scheduled start (SS) and scheduled completion (SC) weeks for keyop
8	M/H EST	KOP-CURR-MHEST	Estimated man-hours to complete keyop
9	TOT USED	KOP-MHUSED TO DATE	Man-hours used on keyop to date
10	M/H REMN	KOP-CUR-MH-REMN	Man-hours remaining to complete keyop
11	QA	KOP-QA	Quality Assurance "S' to be performed by ship's force; "Y' to be performed by industrial activity; "T" to be performed by tender; blank no QA required

Item Number	Column Heading	Input Mnemonic	Description of Data
12	MONTH	N/A	Month and Sunday date of a four-week period in the availability; report is restricted to a four-week envelope; ship selects the four weeks by designating first week
13	M/H USED	KOP-MHUSED-THIS-WK	Man-hours worked on keyop in current week
14	F	KOP-FNSH-FLG	Finished "F" is inserted in this column when keyop has been completed
15	SS WK	N/A	Scheduled start (SS) weeks for keyops; entries are made only if changes are required
16	SC WK	N/A	Scheduled completion (SC) weeks for keyops; entries are made only if changes are required
17	M/H REMN	N/A	Man-hours remaining to complete keyop; entries are made only if changes are required
18	KOP	KOP-KOP-NR	A step in the completion of a job
19	DESCRIPTION	KOP-DESC	Description of work performed on keyop
20	COMPARTMENT	KOP-CMPT-NR	Space that will be affected when the work is being done, used as an identifier for S4 interface
21	KE	JOB-KEV	Key event; the key event number represents a milestone in the availability; key events and their dates are normally provided by the shipyard/contractor
22	WEEK	N/A	Number of each week relative to the beginning of the availability
23	WEEK	N/A	Number of man-hours scheduled for keyop in week under which it is listed (man-hours REMN divided by scheduled weeks remaining to complete keyop

Item Number	Column Heading	Input Mnemonic	Description of Data
24	N/A	N/A	Question marks (???) indicate a jeopardy condition for that keyop, e.g., "NOT STARTED," "NOT COMPLETED," or "NOT SCHEDULED"
25	PRI	JOB-PRI	3M system priority or special priority established by the TYCOM
26	WRITE-IN SECTION	N/A	When a keyop not scheduled during the four weeks covered by this report is started; enter JCN and keyop number and report man-hours used as previously described; changes in a man-hour est and keyop scheduling may also be made if required
27	WEEK USED		Number of man-hours used the previous week

APPENDIX C

COVER LETTERS AND SURVEY FORM

MEMORANDUM

30 July 1988

From: LT Michael MANSFIELD, Computer Technologies Office (Code 37), Naval Postgraduate School, Monterey, CA 93943

To: Commanding Officer, USS RICHMOND K. TURNER (CG-20)

Subj: Data Collection on the Usability of the Fleet Management System - Real Time (FMS-RT)

Encl: (1) Ten Copies of a Usability Survey of the FMS-RT System

1. I respectfully request your commands participation in a survey of the usability of the FMS-RT system. Only 25 ships have used this system since it entered the fleet in January 1988. Your ship is one of only a very few capable of assisting us in collecting valid user evidence to help improve this system.

2. This survey is part of my thesis on the FMS-RT system. PERA (CRUDES) Philadelphia is the sponsor of this research. The results of this survey will be available through the Postgraduate School or through PERA (CRUDES).

3. I respectfully request that the ten surveys sent as enclosure (1) be completed by various members of your command. We desire that they be distributed evenly between those who fill out the input forms like workcenter supervisors and those who interpret and make decisions based on the output like division officers. It is important that the people in your command that actually put the changes into the computer are part of the ten men surveyed.

4. We realize your time and your crews time is very valuable and is overly burdened during a major overhaul period like the one you are presently going through or recently completed, however your help is needed to improve this new system. We would appreciate your assistance in this data collection effort.

Very Respectfully,

Information for Survey Participants

The purpose of this survey is to ascertain the strengths and weaknesses of the FMS-RT system you are currently using aboard your ship. Your name is not important, all that is important is that you are responsible for either entering data into the system through the various input forms or you are responsible for determining what to do based on the output of the system.

The FMS-RT system entered the fleet in January 1988, therefore, it is important to get feedback from the user's of strengths, weaknesses, and possible enhancements. Your responses will be correlated with other ships within your fleet. We anticipate responses form about eight to ten ships per fleet (PACFLT and LANTFLT). The results of this thesis will be available by request through the Naval Postgraduate School and through Naval Sea Systems Command Detachment PERA (CRUDES) Philadelphia, PA 19112. Additionally, each surface type commander will receive a copy of this report.

Only about 25 ships have used this system since it reached the fleet. Your honest opinion is needed to create valid evidence to improve the FMS-RT system for the future. Feel free to attach handwritten listings of problems or improvements if you run out of room on the last question. What you say does matter and can have significant impact on the future of this system. The more detailed the information you provide, the better the results.

In summary, the results of this survey will go to the people responsible for maintaining the FMS-RT system and your type commander. The results will be fleet specific. Your participation is essential to make this system better. We know your time is valuable, but a little time spent now may save many hours of agony spent by others trying to figure out problems with a faulty system. This is your chance to make at least this system work better for you. Thank you very much for your cooperation.

Usability Survey of the
Fleet Management System - Real Time (FMS-RT)

COMMAND:________________

The purpose of this study is to measure how <u>you</u> feel about certain aspects of the computer-based FMS-RT system you have or are currently using.

On the following pages you will find different factors, each relating to some aspect of the FMS-RT system. Please rate each factor on the descriptive scales that follow it, based on your evaluation of the factor.

1. What is your position at your command?
   Division Officer_____
   Chief Petty Officer (E7 - E9)_____
   Work Center Supervisor_____
   FMS-RT Data Processor_____
   Other (specify)_____________

2. How many major overhauls (ROH's, PMA's or SRA's) have you gone through?____

The scale positions are defined as follows:

```
adjective X :___:___:___:___:___:___:___:  adjective Y
             (1) (2) (3) (4) (5) (6) (7)
```

(1)	extremely X	(5)	slightly Y
(2)	quite X	(6)	quite Y
(3)	slightly X	(7)	extremely Y
(4)	equally X or Y		

The following example illustrates the scale positions and their meanings:

My vacation in Australia was:

```
restful  :___:___:___:___:___:___:_X_:  hectic

healthy  :___:_X_:___:___:___:___:___:  unhealthy
```

According to the responses, the person's vacation was extremely hectic and quite healthy.

INSTRUCTIONS

a. Check each scale in the position that describes your evaluation of the factor being judged.

b. Check every scale; do not omit any question.

c. Check only one position for each scale.

d. Check in the space, not between spaces.

```
THIS, NOT THIS
:_X_:___X___:
```

e. Work rapidly. Rely on your first impressions.
ANSWER BASED ON YOUR FEELINGS.

3. Degree of training provided on the FMS-RT and overhaul process:

complete :___:___:___:___:___:___:___: incomplete

superior :___:___:___:___:___:___:___: inferior

4. Users' understanding of the objectives of the FMS-RT:

insufficient :___:___:___:___:___:___:___: sufficient

complete :___:___:___:___:___:___:___: incomplete

5. Users' feeling of participation in the overhaul management process by using this system:

positive :___:___:___:___:___:___:___: negative

insufficient :___:___:___:___:___:___:___: sufficient

6. Attitude toward using the FMS-RT:

cooperative :___:___:___:___:___:___:___: belligerent

negative :___:___:___:___:___:___:___: positive

7. Reliability of output information:

high :___:___:___:___:___:___:___: low

complete :___:___:___:___:___:___:___: incomplete

8. Relevancy of output information to overhaul planning:

relevant :___:___:___:___:___:___:___: irrelevant

useful :___:___:___:___:___:___:___: useless

9. Accuracy of output information:

inaccurate :___:___:___:___:___:___:___: accurate

certain :___:___:___:___:___:___:___: uncertain

10. Number of people involved in communicating changes in data: (Check one)

Too Many_____
Just Right_____
Too Few_____

11. Number of changes to data per week. Changes include addition to, deletion of, and modification of the data.__________

12. As a user of the FMS-RT would you like it to be interactive? Interactive computer systems are like SNAP I and II where you follow the commands on the screen to enter or change data. These type systems would allow changes to the ships database just like a CSMP addition, deletion or change is made with various level of authority for approval.

YES_____ NO_____

13. Do you see a need to see what other ships in your class did during their overhauls or do you see each overhaul as a separate event with little to no relation to other ship class?

I see the need to look at other ships data._____
I see no need to look at other ships data._____

14. Are the reports generated in a useful format?

YES_____ NO_____

15. Did your training for overhaul on the FMS-RT teach you how to use the output reports as a tool to manage the overhaul process?

YES_____ NO_____

16. Do you use another system in addition to FMS-RT to track job status like a manual system devised internally?

YES_____ NO_____

17. How do you evaluate the overall usability of the FMS-RT?

Extremely useful_____
Quite useful_____
Better than nothing_____
More of a problem than a useful tool_____

18. What coast did you receive your training on: (Circle one)

East or West

19. List any improvements you would like to see made in this system or problems encountered when trying to utilize this system:____

____

____

____

____

____

____

Thank you very much for your cooperation.

APPENDIX D

FMS-RT PROBLEMS AND ENHANCEMENTS

Question 19 of the usability survey asked the respondent to list any improvements he would like to see made to the FMS-RT system or any problems he encountered when trying to utilize this system. Of the 120 survey responses, 76 respondents provided the following list of problems and possible enhancements. The remaining respondents did not provide an answer to this question. The number in parentheses after any of the items indicates the number of respondents who made the same or very similar comments; the letter "P" indicates a problem in the system and the letter "E" indicates an enhancement to the system.

- Training on FMS-RT was incomplete. (18P) (The researcher looked in detail at this problem. Its cause was the transition from SFOMS to FMS-RT. The ships already in overhaul had to switch systems partway through and did not receive the FMS-RT Phase I and II training. They received a one- to two-day, scaled-down training program specifically on FMS-RT.)

- Make the system interactive so that work center supervisors can make changes to their part of the database when they have the time. During overhaul, work center supervisors must submit their reports by a certain deadline and receive reports at a certain time. It would be helpful if this system was part of the SNAP system and could be used all the time for weekly work schedules, etc. (18E)

- Incorporate training on *how* to use the output forms in managing the overhaul. More emphasis on how to efficiently use FMS-RT as a tool rather than how to read and fill out reports. We need to know what the reports are telling us the problems are. (17P)

- FMS-RT needs a percentage completion field for each job and a remarks space to enter detailed information. The system is weak at tracking jobs at the end of the overhaul, when more information is needed to provide the commanding officer adequate detail to support major decisions, like crew move-aboard and other upcoming events. (16E)

- The output reports need to be in a more useful format. The reports should be created by a group of users, like commanding officers make a generic report form for their use and division officers and work center supervisor make up the forms they need to use. Get the users to make the standard reports in a more useful format. (15P)

- Provide a tutorial so people interested can learn how to use the system and its software. The current documentation is not written at the level of the normal user. (14E)

- Totally automate the material tracking function. Link the computer aboard the ship to the Naval Supply Center (NSC) or Ships Parts Control Center (SPCC). (12E) (The researcher's limited investigation of this enhancement found that the software would have to link into the Supply Systems Uniform Data Automated Processing System (UDAPS) either at the local NSC or at SPCC. The computer would have to use the requisition number as the primary field to interface.)

- The form feed on the graphics does not operate correctly. When all departments are selected, extra spacing is inserted. (12P)

- The Worklist Form and Worklist/Material Form do not print compartment numbers correctly. They leave out the "-." (11P)

- The Scheduling Gantt Chart dates across the top do not print properly. The calendar may print six weeks of December when there were only five and the sixth week should have been January. The number of the day is correct, but the month function has a tracking problem. (11P)

- In SFOMS, they created an initial SFWP and the crew corrected that and added or deleted jobs as applicable. This was helpful in getting the ship started because they could look at their jobs. They had reports that applied to them. This made acceptance of a new system easier than the FMS-RT system, where the ship has to create the initial SFWP and correct it as time passes. As an enhancement, create that initial SFWP. (10E)

- The printer dip-switch settings are not provided to the user either in the FMS-RT Operating Manual or in the FMS-RT Administrative Manual. (10P)

- Error messages do not stay on the screen long enough. (10P)

- The system has no "what if" or query capabilities and has very limited sort capabilities. (9E)

- Have FMS-RT provide the overhaul SITREP. The SITREP can be made into a standard form by post-overhaul commanding officers and the type commanders. (9E)

- Prepare a report of all jobs linked to a particular key event, like the Light-Off Examination. This permits concentration of effort in meeting critical shipyard events. (8E)

- When control-F10 is selected for producing all department charts, the system loops with the same chart being prepared. (8P)

- Add the capability to add a key operation to a finished job, as well as the ability to add and finish key operations at one screen. (7P)

- The Workload Forecast and Summary Report does not update man-hours scheduled and man-hours used to the left of the I-line. (5P)

- Prepare a critical job-tracking form. The form can be limited in the number of jobs that can be on it to ensure commands only have a limited number of critical jobs. The entry of jobs to the list is controlled by the commanding officer or his delegated representative. The list has very detailed information, such as material requisition status and current job status in a brief, remarks-type format. (4E)

- Ensure all menu selections are consistent. For some menu selections you have to hit the enter key, but for others you select the number and it automatically takes you to the part of the program you want. (3P)

- Do away with the four-week window column on the Workload Forecast and Summary Reports. (2E)

- Change the color of the screens. The red screen on a black background is disturbing to the eyes. The colors make it hard to do changes in one long sitting because you get headaches from looking at the screens for an extended period of time. (2P)

- The dual hard disk is hard to use. Back-ups should be automatic when existing from any part of the program. Provide an easy, automatic back-up capability. This may need prompts as you exist, like "Before exit function is complete, do you want the transactions from this session saved? Yes or No." (1P)

- The documentation on the system is poor. Provide the ship with better user manuals and a help line (a phone help service). (1P)

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